

A
SYLLABUS
OF
A COURSE OF
CHEMICAL LECTURES

READ AT
GUY'S HOSPITAL,

BY
WILLIAM BABINGTON, M.D.
ONE OF THE PHYSICIANS TO THE HOSPITAL,
AND
WILLIAM ALLEN, F.L.S.

LONDON:
Printed by W. PHILLIPS, George Yard, Lombard Street.

1802.

204-1118

181-335-201-202

181-335-201-202

181-335-201-202

181-335-201-202

PREFACE.

IN every Science taught by Lectures, a Syllabus of the Course has been found of advantage to the Student. At the same time that it lays before him a comprehensive outline of the subject, and points out the several divisions and their arrangement with respect to each other,—it defines the meaning and extent of scientific terms, by shewing him their appropriate application and use, and thus instructs him in the language while he is acquiring the rudiments of the science.

As the objects of Chemistry are various, and its views extensive, so likewise is the connection of its principles subtle, and their investigation complicated

complicated and minute: hence the aid of such a synopsis is perhaps even more requisite in this than in any other branch of Natural Philosophy. In proportion too as modern improvements have enlarged the scope, they have increased the utility of a Prospectus to explain it; and upon taking a retrospect of the last five and twenty years it will appear, that the discoveries within that period are so numerous and important,—the change which the Nomenclature has lately undergone is so essential and entire, that the Chemistry of the present day, compared with that of former times, may not improperly be considered as a new science expressed in a new language.

On these grounds it has been thought right to draw up the following Syllabus of the Lectures delivered at this Hospital.

As the Course is necessarily designed for Medical Students, particular attention has been bestowed on those parts which relate to their profession. It is not, however, confined to this object alone. Chemistry is now so intimately connected with various departments of

of Science, and with most of the Arts and Manufactures whether useful or ornamental, that an acquaintance with it has become in some degree necessary in the general system of education; and however different the views with which the Gentleman, the Artist, and the Manufacturer may enter upon its study, each will obtain information adapted to the particular line of his pursuit, that will amply reward him for the time he may spend in acquiring a competent knowledge of its principles.

Agreeably to this view of the matter, an endeavour has been made to point out the application of these principles, not only to the purposes of Medicine, but to most others to which Chemistry is in any way allied; and it is hoped that, independently of advantage during the period of teaching, this Syllabus may be useful to Students when they have ceased to attend;—that by future perusals they may not only recal such information as length of time or diversity of employment had erased from their memories,—but that it may also serve as a general outline of the science, to be filled up

at

at their leisure,—as a systematic arrangement to which they may refer whatever knowledge they shall hereafter obtain.

Although the systems of the older Chemists are now exploded, and many of their principles shewn to be fallacious, their works are still acknowledged to contain many valuable facts and observations. But the ancient Nomenclature differs so widely from the modern, that the Student of the present day often finds the meaning of these authors involved in considerable obscurity. To obviate this difficulty as much as possible for the learner, tables are subjoined drawn up after the manner of those proposed by *M. M. Morveau, Lavoisier, &c.* in which the old and new names of chemical substances are so classed, as to be brought under the eye, and compared at one view; and as some pains have been taken to render these tables at once copious and correct, it is hoped they will on most occasions be found to answer fully their intended purpose.

As it is not discoverable from this Syllabus, which treats only of the chemical part, it may
be

be proper to mention, that the Course to which it refers, is rendered additionally illustrative of General Science, by introducing occasionally, and in their proper places, such parts of Experimental Philosophy as it is more immediately connected with. — By the free access, likewise, to an extensive Laboratory, the Student has an opportunity of seeing the various chemical processes conducted upon a scale corresponding with the expenditure of a large Hospital, and thereby of becoming familiarly acquainted with every step necessary in the management of such operations ; — without which the demonstrations of a Lecture-room will seldom acquire that force which is necessary to fix them in his memory, and enable him to apply them with readiness and effect upon any future and distant occasion.

Digitized by the Internet Archive
in 2020 with funding from
Wellcome Library

<https://archive.org/details/b31899134>

A

SYLLABUS OF CHEMISTRY.

INTRODUCTION.

OF the properties of *Matter*, the subject of experimental philosophy in general.

These either common to all bodies, as *Extension*, *Impenetrability*, *Divisibility*, *Weight*; or proper to particular bodies, as *Colour*, *Figure*, *Texture*, *Solubility*, &c.

From the consideration of the peculiar properties of *Matter* arises its distribution into different *Kinds*; and from the action of *these* upon each other, the various *Combinations* and *Decompositions*, the study of which constitutes the province of CHEMISTRY.

CHEMISTRY therefore defined, *The Science of the Composition and Decomposition of the heterogeneous particles of Matter*; or “that which

A teaches

teaches the intimate and reciprocal action of bodies upon each other."

Of the distinction and connexion between this, and other branches of natural knowledge, more especially *Natural History*, and *Natural* or *Experimental Philosophy*.

What is generally understood by the *Vis Inertiæ* of matter.

Of the *Motion* of bodies, as communicated to them by *external Impulse*, or excited in them by their disposition to *attract*, or *repel* each other.

Of the different species of *Attraction* which originate from this disposition, viz. of *Magnetism* — of *Electricity* — *Capillary Attraction* — *Attraction of Gravitation* — *Attraction of Aggregation* or *Cohesion*, and *Chemical Attraction*.

OF THE ATTRACTION OF GRAVITATION.

This affords the means of estimating the *Specific Gravity* of Bodies.

Every particle of matter equally acted on by *Gravity*.

Absolute

Absolute Gravity, the force with which all bodies are attracted to the centre of the earth; those which contain the greatest number of particles under a given surface consequently heaviest.

Specific Gravity, a comparison of these forces or of the *Weight* of bodies with their *Bulk*, or with an equal bulk of another body.

Water generally assumed as a standard and estimated at 1 or unity ~~or 10 or 100 or 1000~~.

Bodies heavier than water, said to be of greater specific gravity, those that are lighter of less specific gravity.

OF THE ATTRACTION OF AGGREGATION.

The *homogeneous* particles of bodies united by this Attraction with different degrees of force: hence *Hardness*, *Softness*, *Fluidity*, state of *Vapour*, and of *Air* or *Gas*.

Also affected by it in different modes: hence *Brittleness*, *Ductility* and *Malleability*; hence also *Texture*, and *External Figure*.

Crystallisation most regular when the particles of a body are most at liberty to act on each other, as on slow evaporation after previous solution; also the more homogeneous the particles the more regular their arrangement.

Instances comparatively few of bodies different in their kind assuming similar forms, or of the same body assuming different forms: hence the importance of *Crystallography* and use of the *Goniometer*.

Distinction between *primitive*, and *derivative* or *secondary* crystals—Theory of *Abbé Hâuy*—Numerous examples of *Crystallisation* in the concrete *saline Bodies*, from their ready solubility in water and the facility with which this may be separated—many also in the *earthy* and *metallic Bodies* and in some of the *combustible*, as in *Sulphur*.

OF CHEMICAL ATTRACTION.

This a principal agent in all chemical operations and phenomena. It differs from the foregoing, in acting exclusively between the particles of such bodies as are *dissimilar*, or *heterogeneous*.

It

It takes place amongst the *more minute Particles* of bodies, and at *insensible Distances*.

It requires that these should possess a certain degree of *Fluidity*.

It produces in their properties very remarkable changes, of *Temperature*, *Specific Gravity*, *Texture*, *Colour*, *Taste*, *Smell*, &c. so that the properties of the compound can seldom be deduced from those of its component parts.

This attraction exerts itself between different bodies more or less powerfully:—hence the important doctrine of *Chemical Affinity*, and the construction of tables of *Simple* and *Compound Affinity*, called also tables of *Single* and *Double Elective Attraction*.

Of *Saturation*, or the limitation to the proportions in which certain bodies *chemically* unite.

Of the means by which the agency of *Chemical Attraction* may be increased or diminished, and its influence in effecting the decomposition of bodies and resolving them into their constituent parts or elements.

The *Simple Substances* thus obtained, and of which all the others hitherto examined
appear

appear to be composed, are *Light, Caloric, the Electrical and Galvanic Fluids, Oxygen, Hydrogen, Nitrogen or Azote, the fixed Alkalies, Earths, Metals, Carbon, Sulphur and Phosphorus.*

OF CALORIC.

How the terms *Caloric, Matter of Heat, Fire, Temperature, &c.* are philosophically to be understood.

Of the various opinions which have been entertained with regard to the nature of *Caloric.*

In what respects it differs in its general properties from, or is analogous to, *Light, Electricity, and Galvanism.*

Justly considered as a fluid of universal agency.

It exists either in a *loose* state, producing in different bodies, *Warmth, Expansion, Fluidity, Volatility, &c.* in proportion to its quantity; or in a state of *Combination*, in which its properties cease to be evident; in the one case called *sensible*, in the other *latent*.

Caloric in a *sensible* or *loose* state has a tendency

dency to diffuse itself among contiguous substances, so as to maintain in them an uniformity of temperature.

It passes from one body to another with more or less celerity according to its intensity. *Dense* bodies also transmit it more readily than *rare*: hence the distinction between more and less perfect *Conductors of Caloric*.

In *fluid* bodies it keeps up a perpetual circulation of their particles.

It appears to have for different bodies different degrees of *Elective Attraction*.

Equal quantities of *Caloric* produce unequal temperatures in equal quantities of dissimilar substances. Bodies therefore said to have different *Capacities for Caloric*, or to differ in their *specific or comparative Heats*.

The *specific Caloric* of bodies best measured by the quantity of ice or snow which they are found capable of melting.

The capacity of bodies for *Caloric* varies according to their state of aggregation.

The *Caloric* which a body gives out in passing from one state of aggregation to another, it will again absorb in resuming its original state, and *vice versa*.

A variation

A variation in the *Temperature* of bodies universally accompanied by a variation in their *bulk*.

In some the dilatations and contractions are found to correspond with the increase or diminution of *Caloric* by which they are occasioned: hence the construction of the *Thermometer*.

Of the precautions to be observed in the application of this useful instrument.

Of the *Liquefaction*, *Melting*, or *Fusion* of bodies.

Of their *Volatilization*, or conversion into vapour by *Caloric*.

Increase of *Caloric*, by lessening the attraction of aggregation, sometimes diminishes and sometimes augments the disposition to union between different bodies.

The effects of *Cold*, or diminution of caloric, in many instances equally remarkable.

Bodies in a state of vapour possess a high degree of *Elasticity*: hence the effects of the *Steam Engine*, as depending on the expansive power of volatilized water.

To the head of *Evaporation* may also be referred

referred the processes of *Distillation*, and *Sublimation*.

Bodies heated to a certain degree may be thereby either rendered *luminous* without suffering any other essential change; or, if in contact with air, may undergo an entire alteration in their properties: in the one case they are said to be *ignited*; in the other, *burned* or *inflamed*.

The phenomena and effects of *Combustion* therefore referred to the head of *Oxygen*.

OF AERIFORM SUBSTANCES OR GASSES.

These consist of a solid ponderable substance or *Base* combined in a peculiar manner with *Caloric*.

The property of the resulting gas depends upon the nature of its *Base*.

Those not condensable at common temperatures, distinguished by the name of *Permanently elastic Fluids*.

Method of ascertaining the *absolute* and *specific Gravity* of gases, and computing their
volume

volume under different circumstances of *Pressure* and *Rarefaction*.

Elasticity of the air.—Theory of the *Air-Pump*.

Of Oxygen Gas.

Called formerly *Dephlogisticated*, *Pure*, *Empyreal*, or *Vital Air*.

One of the most important discoveries of modern Chemistry.

Forms a constituent part of the *atmosphere*.

Obtained most readily from *Metallic Oxyds*, and compounds of the *Nitric* and other acids, by the application of heat.

Its purity best ascertained by exposure to a solution of *green Sulphate* or *Muriate of Iron* saturated with *Nitrous Gas*, or by mixture with the Gas itself: *Eudiometer*.

Somewhat heavier than *Common Air*.—100 cubical inches at the temp. of 60 *Farenh.* and at 30 inches *Bar. press.* weigh about 34, 5 grains.

Is absorbed by many bodies upon simple exposure, and thereby often produces in them a change both of colour and consistence.

Serves

Serves the purposes of *Respiration* and *Combustion* in an eminent degree.

In *Respiration* is diminished in bulk in proportion to its purity, and by uniting with *Carbon* produces *Carbonic Acid Gas*: hence the supposed function of the *Lungs*, and origin of *Animal Heat*.

In *Combustion* it varies in its effects according to the nature of the *Combustible Substance*, and the manner in which it is employed.

It destroys the splendour and tenacity of the *Metallic Bodies* when they are exposed to it at a high temperature, and gives them an encrease of weight proportioned to its own consumption: hence the modern theory of *Calcination*.

To *Sulphur*, *Phosphorus*, and *Charcoal*, in the act of burning, it communicates *acid* properties; which are more or less distinct as the combustion or decomposition of the *Gas* has been more or less complete.

The basis, therefore, of this fluid considered as the universally *Acidifying Principle*, and hence denominated *Oxygen*:—hence also the terms *Oxyd*, *Oxydation*, *Oxygenation*, &c.

By combustion with *Hydrogen Gas* (so named from this property) it forms *Water*, together
with

with a portion of *Nitric Acid*, if the combustion be rapid.

Of Azote or Nitrogen Gas.

Called formerly *Phlogisticated Air*, and *Mofete*.
Has never yet been found uncombined.

Remains after the abstraction of *Oxygen Gas* from *Atmospherical Air*, by exposure of the latter to *Sulphuret of Potash*, to a mixture of *Iron Filings* and *Sulphur*, &c.

Obtained also by mixing *Oxymuriatic Acid* with *Ammoniacal Gas*.

When pure has a faint smell, but no taste, and is rather lighter than *Atmospherical Air*.

100 cubical inches, *Therm.* 60° *Bar.* 30° weigh about 30, 4 grs.

If inspired is instantaneously destructive of *Animal Life*, and extinguishes *Flame*; but does not impede *Vegetation*.

Differs from most other *Gasses* in being but in a small degree capable of absorption by *Water*, or by the liquid forms either of *Acids* or *Alkalies*.

Evolved

Evolved in the decomposition of *Animal* and *Vegetable Substances*, of which it forms a constituent part.

When mixed in a certain proportion with *Oxygen Gas* and exposed to the *Electrical Spark*; it produces *Nitric Acid*; and by union with *Hydrogen Gas* it forms *Ammonia*—from the former of these properties it takes the name of *Nitrogen*.

Of the means thought to be employed by nature to maintain a due proportion between this and *Oxygen Gas* in the composition of the *Atmosphere*.

Of Hydrogen Gas, or Inflammable Air.

Found in a disengaged and impure state in *Coal Mines*, on the surface of *Stagnant Waters*, and rising through the waters of certain *Springs*.

Obtained also artificially from *animal, vegetable, and bituminous* matter by distillation; from *Essential Oils, Alcohol, Æthers, &c.* by the application of heat; and from *Ammoniacal Gas* by means of the *Electric Spark*.

But

But purest from the decomposition of *Water* by *Metals*, as above stated; or during their solution in *diluted Acids*.

When pure, between 11 and 12 times lighter than *Atmospherical Air*: hence the construction of *Aërostatic Machines*.

Smell adventitious.

100 cubical inches at a Temp: 60 *Farenht.* and 30 inches *Bar. press.* weigh 2. 8 grs.

Combined with *Oxygen* in the proportion of about 15 *Hydrogen* to 85 *Oxygen* by weight, it forms water, from the decomposition of which these fluids may be both obtained in a gaseous state, and therefore considered as its elements.

Hence the effects of *Water* in promoting *Combustion*, in the *Oxydation* of *Metals*, in furnishing *Oxygen Gas* from vegetables under the influence of *Light*, &c. &c.

In the combustion of *Hydrogen* with *Oxygen Gas*, the purity of the resulting water depends on the slowness or rapidity with which the process is conducted.

On inspiration proves noxious to *Animal Life*, apparently by the exclusion of the *respirable* part of the *Atmosphere*.

Sulphurated, and *Phosphorated Hydrogen Gas*
are

are varieties of *Common Hydrogen Gas*, in which the bodies from whence they are denominated are held by it in solution.

In its nascent state it is found to be capable of combining both with *Oxygen* and *Azote*; with the one producing *Water*, as in the case of combustion; and with the other, *Ammoniac*.

Hydrogen and *Nitrogen Gasses* by their union compose *Ammoniac*.

Of Nitrous Oxyd Gas.

Procured from the decomposition of *Nitrate of Ammonia* with a gentle heat. Consists of *Oxygen* and *Azote* in intimate union. In some of its properties resembles *Acids*.

100 cubical inches at a middle temperature and pressure, weigh about 50 grains—Is decomposed by combustible substances at a very high temperature—Soluble in double its volume of *Water*, to which it communicates a sweetish taste.

Remarkable for the intoxicating effects which it produces in respiration.

Gaseous

Gaseous Oxyd of Carbon.

Procured by exposing the *Oxyds* of *Metals* and *Charcoal*, or a mixture of powdered *Marble* and filings of *Zinc* to a red heat.

Till lately considered as *Hydrogen Gas* holding *Carbon* in solution, and called by *Priestly* *Heavy Inflammable Air*, but proved by *Cruikshank* to be a distinct species, having *Carbon* for its basis combined with a limited proportion of *Oxygen*, inferior to that which constitutes *Carbonic Acid*.—100 cubical inches, middle temperature and pressure, weigh about 20 grs.—It is inflammable, and burns with a lambent blue flame, but does not explode with common air. And by combustion is almost wholly converted into *Carbonic Acid*.

The *Ammoniacal* and *Acid Gasses* referred to the class of *Salts*.

Method of ascertaining the presence of particular gasses and of separating them from each other.

OF SALTS.

These characterized by being *sapid* or of a *saline taste* and readily *soluble* in water; further remarkable for their disposition to act on, or to be acted upon by most other substances, as also for the regularity of the forms which they are in most instances found capable of assuming—*Crystallisation*.

Their solution in water for the most part accompanied by a diminution of temperature: hence the usual means of producing *artificial Cold*.

On exposure to air generally either receive or impart moisture: hence said to be *deliquescent* or *efflorescent*.

When heated, the greater number undergo either *watery* or *igneous Fusion*—some are volatilized, and many more or less completely decomposed.

They are divided into *simple* and *compounded*—the more simple are, *Alkalies* and *Acids*—the compounded, such as result from the union of these with each other, *Neutral Salts*,—or of the acids with earths and metallic oxyds, *Earthy* and *Metallic Salts*.

OF ALKALIES.

Distinguished by being of a pungent, and lixivial or urinous *Taste*, and by changing most vegetable *blue* colours to *green*, and many of the vegetable *yellow* colours to *brown*.

Have a strong attraction for *moisture*.

Produce no alteration on each other, but manifest an extensive disposition to unite with other bodies. With *Acids* they constitute *Neutral Salts*.

They precipitate from their solutions most of the *Earths*, and all the *Metallic Oxyds*, several of which they are capable of re-dissolving.

With *unctuous substances* they form *Soaps*; with *Silex* and *Alumine* various kinds of *Glass* and *Porcelain*; with *Sulphur*, *Alkaline Hepars* or *Sulphurets*.

The substances most perfectly *Alkaline* are *Potash*, *Soda*, and *Ammonia*; the ~~two former~~ still considered as ~~simple bodies~~, the latter remarkable for its volatility in a moderate temperature, and now known to be a compound of *Hydrogen* and *Azote*.

Many

Many of the *Earths* also have distinct alkaline properties, more especially *Baryt*, *Strontian* and *Lime*.

Of Potash.

Appears to be a constituent part of most *vegetable* substances; it is also found to enter into the composition of several *minerals*. Usually obtained from the ashes of the former in the state of *common Potash*, by elixation in water and evaporation to dryness; or in that of *pure Potash* by subsequent treatment with *Lime*.

Form, *concrete*. Taste, *extremely pungent*. *Caustic*. Colour, *white*.

Has a strong attraction for *moisture*.

On solution in *Water* produces an increase of temperature (*Aqua Kali puri* P. L.)

Combines with all the *Acids*, and in most instances with a force of attraction superior to that of any other substance.

Fusible in a moderate, and volatile in an intense *Heat*.

Promotes the fusion of *earthy Bodies* and of *metallic Oxyds*; hence the preparation of different kinds of *Glass*. Unites with *Sulphur*, and renders it soluble in water (*Kali Sulphuratum* P. L.)

The order of attraction of this alkali, in the moist way, *Sulphuric, Nitric, Muriatic, Sebacic, Fluoric, Phosphoric, Oxalic, Tartareous, Arsenic, Succinic, Citric, Formic, Lactic, Benzoic, Acetic, Saccho-lactic, Boracic, Sulphureous, Nitrous, Carbonic, and Prussic Acid*; Water, *Unctuous Oils, Sulphur, Metallic Oxyds*; in the dry way, *Phosphoric, Boracic, Arsenic, Sulphuric, Nitric, Muriatic, Sebacic, Fluoric, Succinic, Formic, Lactic, Benzoic, and Acetic Acid, Baryt, Lime, Magnesia, Alumine, Silex, Sulphur*.

Sometimes prescribe internally in solution; in the conerete form frequently employed as a *Caustic*.

Of Soda.

Found in great abundance in the mineral kingdom, particularly in combination with
Muriatic

Muriatic Acid.—Obtained, in a pure or caustic form, from *Carbonate of Soda*, by means of *Lime*, as pure or caustic *Potash* is from *Carbonate of Potash*.

Its *Form*, *Colour*, *Taste*, *Causticity*, &c. nearly the same with those of the former *Alkali*.

Has an equally extensive disposition to combine with *Acids*.

Acts powerfully on the *Earths*, and *metallic Oxyds*; also unites readily with *unctuous Substances*,—hence the preparation of *common Soaps*.

Order of Attraction of this *Alkali*, the same as that of *Potash*.

Of Ammonia.

Obtained from the distillation of *Bones* and other kinds of *animal Matter*, but purest from the decomposition of *Muriate of Ammonia*, by *Potash*, *Soda*, or *Lime*.

Form *gaseous*.—Smell extremely *pungent*.—*Caustic*.—*Azotic*.—Lighter than *Atmospheric Air*, in the proportion of 880 to 1000.

Is

Is absorbed both by *Water* and *Spirit*; by the former with great rapidity, producing an increase of temperature and bulk (*Aqua Ammoniacæ puræ* P. L.) On the contrary, *Ice* dissolved in this fluid, produces cold.

Is in a slight degree *inflammable*.

May be decomposed in various ways; as by exposure to *Heat*, by the *Electric Spark*, in the reduction of *Metallic Oxyds*, by the distillation of *Nitrate of Ammonia*, &c. yielding in some cases *Hydrogen*, in others *Azotic Gas*: which gasses by particular modes of combination have been found to reproduce it, and are therefore considered as its elements.

Agrees nearly with the other *Alkalies* in the order of its attraction, both in the humid and dry way.

OF ACIDS.

Appear in general to consist of *Combustible Substances* in union with the base of *Oxygen Gas*, the proportion of which in most cases determines the degree of *Acidity*.—Several of them the immediate result of *Combustion*.

Distinguished

Distinguished by being *sour* to the taste, changing vegetable *blue* colours to *red*, and by their extensive power of combining with other substances.

The properties of the individual *Acids* dependent on the nature of their respective *Bases*: the stronger the attraction of their *Bases* for *Oxygen*, the less intense in most instances their *Acidity*.

All unite readily with water. *Diluted Acids*.

In combination with *Alkalies* form for the most part what are called *Neutral Salts*; with *Earths* and *Metallic Oxyds*, *Earthy* and *Metallic Salts*.

Most of the acids *antiseptic*. Some powerfully *corrosive*.

Admit of different distinctions—from their form, into *solid*, *liquid*, and *gaseous*; from their more usual and abundant sources, into *mineral*, *vegetable*, and *animal*; into such as have *simple* and such as have *compounded* bases.

The more important of the *Acids* are, the *Sulphuric*, *Nitric*, *Muriatic*, *Carbonic*, *Fluoric*, *Boracic*, *Acetous*, *Tartareous*, *Oxalic*, *Gallic*, *Phosphoric* and *Prussic*.

Of Sulphuric Acid.

Formerly called *Acid*, *Oil*, and *Spirit of Vitriol*.

Long considered as the *Universal Acid*.

Seldom found uncombined.

Obtained artificially from the rapid combustion of *Sulphur*, or of a mixture of *Sulphur* with *Nitre*, or from the distillation of *Sulphate of Iron*.

Concentrated afterwards by *boiling*.

When pure, *limpid*, *ponderous*, *unctuous*, *inodorous*, and intensely *sour*.

Specific gravity nearly double that of *Water*.

Has a powerful attraction for *Moisture*, and on mixture with *Water*, occasions a remarkable increase of temperature.

When volatilized by the higher degrees of heat, it assumes the form of a dense white vapour, the first portions of which sometimes congeal if exposed to a moderate cold. (*Glacial Oil or Acid of Vitriol*.)

Combined with *Alkalies* it forms.

1st. *Sulphate of Potash* (*Kali vitriolatum* P. L.) usually prepared from the saline mass which remains after the distillation of *Nitric Acid*.—

Form,

Form, *crystalline*.—Taste, *saltish bitter*.—Difficultly soluble in water; also very difficult of fusion — May be decomposed either in the *moist* way by *Baryt*, or in the *dry* way by calcination with *Charcoal*.—100 parts consist of 40 of *Sulphuric Acid*, 52 of *Potash*, and 8 of *Water*.—Application chiefly *medical*.

2d. *Sulphate of Soda* (*Natron Vitriolatum P.L.*) obtained by solution and crystallisation from the matter left behind in the preparation of *Muriatic Acid*, *Muriate of Ammonia*, or *Muriate of Quicksilver*. Form of its crystals, *prismatic*.—Taste, *bitter*.—Effloresces on exposure to *Air*.—Readily soluble in *Water*.—When exposed to *Heat*, undergoes watery fusion. May be decomposed in the same way as *Sulphate of Potash*.—Used only in *Medicine*.

3d. *Sulphate of Ammonia*; obtained by the union of *Sulphuric Acid* with *Ammonia*, on the addition of diluted *Sulphuric Acid* to liquid *Carbonate of Ammonia*.—Form, *crystalline*.—Taste, *bitter, pungent*.—Easily soluble in *Water*. *Fusible*. *Volatile*.—Employed principally in the manufacture of *Muriate of Ammonia*.

Forms also with the *Earths* and *Metallic Oxyds*

Oxyds particular compounds, to be hereafter spoken of under their respective heads.

By treatment with *Combustible Substances* is generally more or less discoloured, and may be either deprived of a portion of its *Oxygen* and thereby made to assume the form of *Gas*, or totally decomposed and reduced to its original basis, *Sulphur*.

The properties of *Sulphureous Acid Gas*, which may be also prepared by the *slow* combustion of *Sulphur*, in many respects different from those of the *common Acid*; its compounds therefore differently denominated. *Sulphate of Potash*, &c.

The *Sulphuric* superior to most *Acids* in its *Power of Attraction* for other bodies.

Independently of its *Water*, supposed to consist of 61.5 parts of *Sulphur* and 38.5 of *Oxygen*.

The order of its attraction *Baryt*, *Potash*, *Soda*, *Lime*, *Magnesia*, *Ammonia*, *Alumine*, *Metallic Oxyds*, *Water*, *Spirit*.

Employed principally in *Dying*, *Bleaching*, *Tanning*, *Purification of Oils*, and in *Medicine*.

Of Nitric Acid.

Obtained from the decomposition of *Nitrate of Potash* by *Sulphuric Acid*, or by de-aqueated *Sulphate of Iron*.

Purified by re-distilling it from a fresh portion of *Nitre*, or by the addition of *Nitrate of Silver* and of *Baryt*.

In its common form, of a *yellowish* or *orange* colour: when pure, altogether *colourless*: *specific gravity* 1.500.

More *volatile* and less *ponderous* than *Sulphuric Acid*—its *Acidity* equally intense—attracts *Moisture* also from the atmosphere, and unites readily with *Water*; but produces with it a less degree of *Heat*: (*Acidum Nitrosum dilutum* P. L.) *Aqua-fortis*.

Destructive, more immediately than the *Sulphuric Acid*, of the life and texture of bodies to which it is applied.

On mixture with *that Acid* communicates to it the property of dissolving silver: *Aqua Regina*.

Combined with Alkalies it forms,

1st. *Nitrate of Potash* (*Kali Nitratum* P. L.);
obtained

obtained in the East Indies and other countries, by the elixation of certain soils, in which it is either spontaneously and repeatedly produced by their exposure to Air and Light, or formed upon the addition of *Potash*.—Those soils more especially productive which abound in vegetable and animal matter that has run into a state of putrefaction.—Freed from extraneous saline matter by repeated crystallisation.—Form of its crystals *prismatic*.—Taste, *cold, saline, penetrating*.—Much more soluble in hot than in cold water.—In a moderate heat undergoes watery fusion (*Salprunelle*).—An increase of the heat produces a decomposition of its *Acid*, the *Alkali* remaining unchanged.—May be more rapidly decomposed by the addition of *Charcoal*; hence the preparation of *Gun-powder*.—When decomposed in the moist way, by treatment with the *Sulphuric*, furnishes *Nitric Acid*.—100 parts dried at 70 *Farenh.* consist of 44 of *Nitric Acid*, 51.8 of *Potash*, and 4.2 of *Water*.—Used extensively in *Glass-making*, *Metallurgy*, preparation of *Gun-powder*, and for *dietetic and medical* purposes.

2d. *Nitrate of Soda*, called formerly *cubical* or *quadrangular Nitre*. In most of its properties resembles the former.

3d. *Nitrate of Ammonia* ; obtained by slow evaporation, from the combination of *Nitric Acid*, and *Ammonia*.—Form, *crystalline*.—Taste, *cool, bitter, urinous*.—*Deliquescent*.—Easily *fusible*.—Under cautious distillation, yields *Gaseous Oxyd of Azote, Nitrous Gas, and Water* ; but detonates when suddenly heated.

Nitric Acid dissolves all the *Earthy Bodies* except *Silex*.

In its action on the *Metallic Bodies*, it is decomposed to a greater or less degree according to their capability of uniting with a larger or smaller proportion of its *Oxygen*.

Similar effects produced on it by *Charcoal, Phosphorus, Sulphur*, and most other combustible substances ; as also by exposure either to *Light* or *Heat*.

Hence the difference, if any, between *Nitrous* and *Nitric Acid*, and the formation of *Nitrous Gas*, and *Gaseous Oxyd of Azote*.

In some instances, the reciprocal action such as to occasion immediate inflammation, as on mixture with *Essential Oils*.

Of the properties of *Nitrous Gas*—The most remarkable of these its re-producing *Nitric Acid* by the addition, and furnishing pure *Azote* by the subtraction of *Oxygen*.

The

The different forms of the *Nitric Acid* therefore considered as resulting from the union of these principles in different proportions.

100 parts of the *Dry Nitric Acid* said to consist of 68.06 *Nit. Gas* and 31.94 *Oxygen*.—
100 parts of the *liquid Acid*, of 90 *Acid* and 10 *Water*, and 100 parts of *Nit. Gas* of 46.6 *Azote* and 53.4 *Oxygen*, the cubical inch of the *Gas* weighing 335 thousandths of a grain.

The *Order of Attraction* of this acid, the same as that of the *Sulphuric*.

Chief uses, in *Dying*, *Etching*, and *Affaying*; and sometimes employed in *Medicine*.

Of Muriatic Acid.

Obtained by decomposing *Muriate of Soda*, by means similar to those employed in the preparation of the *Nitric Acid*.

Its purest form *Gaseous*.

In this state one-fifth heavier than *Atmospherical Air*; of a pungent odour; *irrespirable*; destructive to *Flame*, imparting to it under extinction

extinction a bright green colour; enflames the skin without discolouring or corroding it.

When dry has no action on the *Metals*, nor on any other of the *Combustible Substances*.

Exposed to a moist atmosphere it becomes *cloudy*—Is readily absorbed both by *Water* and *Ice*, the latter of which it liquefies: in either case it occasions an encrease of *Temperature* and augmentation of *Bulk*, communicating to the water the general properties of an *Acid* (*Acidum Muriaticum* P. L.)

In its liquid and more common form it readily dissolves and unites with all the *Alkalies* and most of the *Earths*.—Its combinations with the former are,

1st. *Muriate of Potash*, formerly called *Salt of Silvi*; a salt but little used.

2d. *Muriate of Soda* (*Common Salt*); obtained by evaporation from *Sea Water*, or the water of *Salt Springs*, or the solution of *Rock Salt*, which is found in several parts of the world in immense quantities.—Form of its crystals *cubical*.—Taste, agreeably *saline*.—Equally soluble in cold *Water* as in hot; soluble also in *Spirit*.—Crystals burst or decrepitate on sudden exposure to *Heat*. Melt in a red heat without decomposition.

sition. May be converted into vapour by being intensely heated.—Promote the fusion of many of the *earthy* and *metallic* bodies.—May be decomposed in the moist way by *Sulphuric* and *Nitric Acids* ; and in the dry way, by the *Phosphoric*, *Boracic*, and *Arsenic*.—May also be decomposed by *Oxyd of Lead* ; hence the preparation of *Turner's Patent Yellow*.—100 parts dried at 80 *Farenh.* consist of 38.88 *Mur. Acid*, 53 *Soda*, and 8.12 *Water*.—Of extensive application in *Agriculture*, *Glass-making*, *Glazing*, *Metallurgy*, *Soap-making*, *Diet*, *Pharmaceutic Chemistry*, &c. &c. &c.

3d. *Muriate of Ammonia*, (*Sal Ammoniacus* P. L.) ; found native in the neighbourhood of *Volcanos* ; prepared also, in large quantities, in the dry way, by double chemical affinity, from a mixture of *Sulphate of Ammonia* and *Muriate of Soda*.—Form, *concrete*.—Taste, *penetrating*, *acid*, *urinous*.—Soluble both in *Water* and *Spirit*.—Crystallises under evaporation into small quadrangular *Prisms*.—Yields its basis readily to both the fixed alkalies, and to lime:—is also partially decomposed by sublimation with oxyd of iron (*Ferrum Ammoniacale* P. L.).—Of extensive application in *Dying*, *Tinning*, *Soldering*, &c. Used also frequently in *Medicine*.

Muriatic acid dissolves also some of the *Metals*, as *Zinc* and *Iron*, with the production of *Hydrogen Gas*; and shews a superiority of attraction for most of the *Metallic Oxyds*.

On mixture, either in the liquid or gaseous state, with *Nitric Acid*, occasions in it a partial decomposition, and thereby taking to itself an additional proportion of *Oxygen*, acquires new properties: *Aqua Regia*.

An analogous change found to be produced on it by distillation from certain of the *Metallic Oxyds*, more especially from that of *Manganese*: hence the preparation of *Oxymuriatic*, or as it was at first called, *Dephlogisticated Marine Acid*.

The sensible properties of this, distinguishable from those of all the other *Elastic Fluids*—Remarkable for its effects both on *Animal* and *Vegetable Colours*—Thought to possess the important property of destroying *putrid* and *contagious Effluvia*—Not so readily absorbed by *Water* as common *Muriatic Acid Gas*—Like the *Nitric Acid* it is decomposed by exposure to *Light*, is readily acted upon by most of the *Metallic Bodies*, and, in several instances, occasions actual *Inflammation*.

Its combinations with salifiable bases (called *Oxy-muriates*) afford *Oxygen Gas* when heated, and pass to the state of common *muriates*: triturated with combustible substances, they inflame and frequently detonate. The most important of these is, *Oxy-muriate of Potash*, obtained by cautiously evaporating and cooling a solution of caustic *Potash*, saturated with *oxy-muriatic Acid*. It crystallises into flat hexhedral prisms or plates, of a pearly *lustre*: *Taste* faintly saline: moderately soluble in *Water*: on exposure to *heat* readily undergoes watery fusion, and, like *Nitrate of Potash*, yields great abundance of *Oxygen Gas*, but of more than ordinary purity: much more remarkable than *Nitrate of Potash*, for its power of detonating on mixture with several of the combustible bodies, as *Charcoal*, *Sulphur*, and *Phosphorus*; more especially the latter.—Successfully employed as an internal remedy in the treatment of certain cases of *Syphilis*.

The chemical affinity of the common form of the *Muriatic Acid* in most instances weaker than that of either the *Sulphuric* or *Nitric*; but the order of its attraction the same.

Its *Basis* as yet unknown.

Employed

Employed principally in *Medicine, Bleaching, Dying and Assaying.*

Of Carbonic Acid.

Called also *Aërial Acid*, and *Fixed Air*.

The natural forms and sources of this acid various: uniformly the result of the burning of *Charcoal*.

Usually collected in its gaseous state from bodies undergoing the *Vinous Fermentation*; or from *Carbonated Earths* or *Alkalies*, by the application of *Heat*, or more commonly by the addition of an *Acid* of superior attraction.

Specifically heavier than *Atmospherical Air*, nearly in the proportion of two to one: hence so frequently found stagnant in *Mines, Caverns*, and other *subterraneous* situations.

Instantaneously fatal, when employed alone in *Respiration*; and equally incapable of supporting *Flame*.

Unites readily with *Water* at a middle temperature, communicating to it *acid* properties, and a consequent solvent power over other bodies:

bodies : hence the nature and imitation of various *Medicinal Springs*.

Its combination with *Water* materially promoted by a diminution of temperature short of freezing, by agitation, and by artificial pressure.

Disposed like other acids to combine with salifiable bases. With *Alkalies* it forms,

1st *Carbonate of Potash* (*Kali Præparatum P. L.*); usually obtained from the ashes of vegetables, by lixiviating them in water, decanting and evaporating to dryness.—Form, *powdery*.—Taste, *urinous*.—Colour, *pearly-white*.—*Deliquescent* in a moist atmosphere (*Aqua Kali P. L.*); may then be crystallised after cautious evaporation.—May be decomposed in the moist way by most of the other *Acids*, or by *Lime*; and in the dry way, by the simple application of *Heat*.—Uses various, as in *Glass-making*, *Bleaching*, *Metallurgy*, *Medicine*, &c.

2d. *Carbonate of Soda*, (*Natron præparatum P. L.*); found native in *Egypt*, the island of *Teneriffe* and elsewhere; obtained also from the ashes of certain marine plants, by elixation, evaporation, and crystallisation.—Form of its crystals, *octohedral*.—Effloresces on exposure to *Air*.—Its other properties and uses nearly similar to those of *Carbonate of Potash*.

3d. *Carbonate of Ammonia* (*Ammonia præparata* P. L.); obtained by distillation from most animal, and some vegetable and mineral substances: or from the decomposition of *Muriate of Ammonia* by *Carbonate of Potash*, or of *Lime*.—Form, *concrete*.—Smell, *pungent*.—Taste, *urinous*.—Very soluble in *Water* (*Aqua Ammoniacæ* P. L.) Soluble also in *Spirit* (*Spiritus Ammoniacæ* P. L.). With unctuous substances forms an imperfect *Soap* (*Linimentum Ammoniacæ* P. L.). Like all the foregoing compounds, may be decomposed by *Potash*, *Soda*, *Baryt*, or *Lime*.

Carbonic Acid now universally considered as consisting of *Carbon* rendered acid by *Oxygen*; for which it has a stronger affinity than any other acidifiable base.

Inferior to most of the *Acids* in its *Attraction* for other bodies.

Order of attraction, *Baryt*, *Lime*, *Potash*, *Soda*, *Magnesia*, *Ammonia*, *Alumine*, *Metallic Oxyds*, *Water*, *Spirit*. Uses chiefly *medical*.

Of

Of Fluoric Acid.

Obtained by decomposing *Fluate* of *Lime* by means of the *Sulphuric Acid*.

Form *gaseous*.

Heavier than atmospheric air, as 1.5 to 1.
Caustic.—*Azotic*.

Unites readily with *Water*, and renders it intensely four.

In union with the *Alkalies*, forms compounds of a gelatinous consistence.

Possesses the remarkable property of dissolving and volatilizing *Silex*.

Dissolves *Zinc*, *Iron*, and *Copper*; the other metals not acted on, unless in the state of *Oxyds*.

Basis unknown.

Order of Attraction, *Lyme*, *Baryt*, *Magnesia*, *Potash*, *Soda*, *Ammonia*, *Alumine*, *Metallic Oxyds*, *Water*, *Spirit*.

Use—*Etching on Glass*.

Of Boracic Acid.

Called formerly *Sedative Salt*.

Found in solution in the water of certain
lakes

lakes in *Tuscany*; or obtained artificially by decomposing *Borate of Soda* by *Sulphuric*, *Nitric*, or *Muriatic Acid*; or by subliming it with *Sulphate of Iron*.

Form, concrete, scaly.—Semi-transparent and of a pearly lustre, and saline acid taste.

Sparingly soluble in *Water*; more so in *Alcohol*, to the flame of which it communicates a greenish tinge.

When united with *Water* easily sublimed.

Fusible without addition into a transparent *Glass*.

By combination with *Soda*, reproduces *Borate of Soda* (*Natron Boracicum* P. L.); obtained, in an impure form, from the spontaneous evaporation of the water of certain lakes in the kingdom of *Thibet*; said also to be found in those of *South America*.—Purified by subsequent solution, boiling, and crystallisation.—Form of its crystals, *prismatic*.—Taste, *styptic*.—Readily soluble in *hot Water*.—Changes vegetable *blue* colours to *green*.—When heated, parts with its water of crystallisation, and melts into a transparent *Glass*, which effloresces on exposure, and may be again dissolved in water.—Serves as a flux for all the *Earths* and most
of

of the *Metallic Oxyds*.—May be decomposed in the moist way, by the *Sulphuric*, and several other acids; in the dry way, by the *Phosphoric* only.—Employed chiefly in *Metallurgy*, and *Glass-making*.

Basis of *Boracic Acid* unknown.

Order of attraction, *Lime, Baryt, Magnesia, Potash, Soda, Ammonia, Alumine, Metallic Oxyds, Water, Spirit.*

Of the Acetous Acid.

Obtained from common vinegar by cautious distillation (*Acetum Distillatum P. L.*).

When pure, without Colour; and in Taste moderately acid.

Not easily decomposed by Heat.

May be concentrated by Freezing.

When separated from *Verdegris* by exposure to Heat, or from *Potash* by addition of *Sulphuric Acid*, assumes the form of *Acetic Acid* or *Radical Vinegar* (*Acidum Acetosum P. L.*): this thought of greater acidity than the *Acetous Acid*, and slightly inflammable.

The latter combined with *Potash* produces,
Acetite

Acetite of Potash (*Kali Acetatum* P. L.); prepared by saturating *Potash* with *distilled Vinegar*, evaporating to dryness, melting the remaining mass, dissolving it in water, filtering and evaporating a second time.—Form, *flakey*.—Colour, *white*.—Taste, *pungent*.—*Deliquescent*.—Easily soluble both in *Water* and *Spirit*.—Its acid decomposed in distillation.—Yields *Acetic Acid* on the addition of the *Sulphuric*.—Used in medicine as a *Diuretic*.

With *Ammonia* it produces, *Acetite of Ammonia* (*Aqua Ammoniae Acetatae* P. L.); prepared by saturating distilled *Acetous Acid* with *Ammonia*.—Form, *liquid*.—Taste, *urinous*.—Employed as a *diaphoretic*; sometimes also used externally as a *discutient*.

Both forms of this acid thought, like all the other vegetable acids, to consist of the binary radical *Hydro-carbon* united in different proportions with *Oxygen*.

Order of attraction, *Baryt*, *Potash*, *Soda*, *Ammonia*, *Lime*, *Magnesia*, *Alumine*, *Metallic Oxyds*, *Water*, *Spirit*.

Further properties and uses referable to the head of *Acetous Fermentation*.

Of

Of Tartareous Acid.

Obtained from *Acidulous Tartrite of Potash* by means of *Lime*, or *Carbonate of Lime*, and the subsequent addition of *Sulphuric Acid* (*Acidum Tartari crystallisatum* P. Suec.). May also be prepared by the *Sulphuric Acid* alone.

Crystallises in small transparent scales or needles. Not altered by exposure to *Air*. Readily soluble in *Water*, and of an agreeably acid taste.

Easily decomposed by *Heat*.

Yields *Oxalic Acid* by treatment with the *Nitric*, and *Acetous* by digestion with *Water* and *Spirit*.

Its more important saline compounds are,

1st. *Acidulous Tartrite of Potash*, prepared from *crude Tartar* (the spontaneous deposit from new wine) by solution and evaporation (*Cremor Tartari* P. L.), or by crystallisation under cooling (*Tartari Crystalli* P. L.).—Form *crystalline*.—Taste agreeably *acid*.—Of little solubility in *Water*.—Decomposed by the application of *Heat*; its chief products, an *Acid liquor*, and *Carbonate of Potash*, which has therefore been called *Salt of Tartar*.—Of various application

cation in the arts, as in *Tinning*, *Dying*, *Hat-making*; employed also extensively in *Medicine*.

2d. *Tartrite of Potash* (*Kali Tartarifatum* P. L.); prepared from the solution of the former, either by precipitating its excess of acid by means of *Chalk*, or by saturating it with additional *Potash* — Form, *crystalline*. — Taste, *saltish-bitter*. — Attracts moisture from the atmosphere; also very soluble in *water*; hence its former name, *Soluble Tartar*. — Decomposed by heat, nearly in the same way as the *Acidulous Tartrite of Potash*. — Employed only in medicine, as a *mild Cathartic*.

3d. *Tartrite of Soda* (*Natron Tartarifatum* P. L.); obtained, by evaporation and crystallisation, from the union of *Soda* with *Acidulous Tartrite of Potash*. — Form of its crystals, *prismatic*. — Taste, *bitterish saline*. — In most of its properties, and in its application, analagous to the *Tartrite of Potash*.

Order of attraction of Tartarous Acid, *Lime*, *Baryt*, *Magnesia*, *Potash*, *Soda*, *Ammonia*, *Alumine*, *Metallic Oxyds*, *Water*, *Spirit*.

Use confined to *Medicine*.

Of Oxalic Acid.

So called from being contained in the *Oxalis Acetofella*, or *Wood Sorrel*.

Obtained from *Sugar*, *Malt*, *Galls*, and various other substances, as well animal as vegetable, by treating them with *Nitric Acid*.

Form, *concrete*. Crystallises into transparent quadrangular *Needles*. Taste very *acid*.

Readily soluble in *Water*: soluble also, and without decomposition, in the *Sulphuric* and other *Acids*, *Spirit of Wine*, *Æther*, *essential* and *expressed Oils*.

Easily decomposed under the application of the higher degrees of *Heat*.

Forms peculiar compounds with the *Alkalies*, with most of the *Earths*, and with several of the *Metallic Oxyds*.

Is more especially remarkable for its affinity with *Lime*, with which it produces an insoluble compound.

Order of attraction, *Lime*, *Baryt*, *Magnesia*, *Potash*, *Soda*, *Ammonia*, *Alumine*, *Metallic Oxyds*, *Water*, *Spirit*.

Used

Used to take out *Iron-moulds*, and as a test for discovering the presence of *Lime*.

Of Gallic Acid.

Obtained from *Infusion of Galls*, by continued exposure to *Air*, edulcoration of the *Precipitate* which takes place, and subsequent *Crystallization*.

Forms small granular or needle-like *Crystals*, of a sour but not astringent *Taste*.

More soluble in *Spirit* than in *Water*.

Burns in the open fire, leaving behind a hard insoluble *Charcoal*.

In close vessels, yields an *acid Liquor* and a *whitish saline Sublimate*.

A similar salt procurable from *Galls*, by *simple Distillation*; this also called *Gallic Acid*.

Remarkable for the property of producing a black colour with *Iron* and its saline compounds; hence the formation of *Ink*.

Hydro-

Hydro-carbon the basis of both these forms of *Gallic Acid*, but united with different proportions of *Oxygen*. Order of attraction, not yet ascertained with sufficient accuracy.

Of Phosphoric Acid.

Sources of this acid various. Usually procured from common *Phosphorus*, by deflagration; or by slow combustion, under long exposure to *Air*; or by treatment with the *Nitric Acid*.

Differs in its sensible properties according to the degree of *Oxygenation*: hence distinguished into *Phosphoreous* and *Phosphoric Acid*.—In the latter form, generally liquid; but by evaporation and cooling crystallisable into quadrangular *Prisms*.

Taste intensely acid, but not corrosive. *Specific gravity* 2.687.

Has a strong attraction for *Moisture*.

Under the application of the higher degrees of *Heat*, fuses into a transparent *Glass*, capable of re-assuming its acid properties by long exposure to *Air* or maceration in *Water*.

With

With the *Alkalies*, *Earths*, and *Metals*, forms particular compounds, the chief of which is, *Phosphate of Soda* (*Soda Phosphorata* P. Edin.); obtained by uniting *Phosphoric Acid* and *Soda* to the point of saturation, evaporating, and cooling. Form *crystalline*. — Taste not unpleasantly *saline*. — *Efflorescent*. — Dissolves readily in *Water*. — Forms a triple salt with *Ammonia* (*Sal Microcosmicus*). — Lately introduced as a *cathartic*.

May, like most of the other acids, be partially or totally decomposed, by treatment with different *inflammable substances*.

In distillation with *Charcoal*, reproduces *Phosphorus*; this therefore considered as its *Radical*.

Order of attraction, *Lime*, *Baryt*, *Magnesia*, *Potash*, *Soda*, *Ammonia*, *Alumine*, *Metallic Oxyds*, *Water*, *Spirit*.

Of Prussic Acid.

Obtained from *Prussiate of Iron* (*Prussian Blue*), by boiling it in a solution of *Potash*, adding *Sulphuric Acid* to the liquor when filtered,
and

and submitting it to distillation ; or by distilling a mixture of *Prussiate* of *Potash* and diluted *Sulphuric Acid*, and re-distilling the product from *Carbonate* of *Lime*.

Form, *gaseous*.

Unites readily with *Water*.

Combines with *Alkalies*, *Earths*, and *Metallic Oxyds*. With *Oxyd* of *Iron* reproduces *Prussian Blue*.

Consists of the same elements as *Carbonate* of *Ammonia*, but in different proportions.

Order of attraction, *Baryt*, *Potash*, *Soda*, *Ammonia*, *Lime*, *Magnesia*, *Metallic Oxyds*, *Water*, *Spirit*.

OF EARTHS.

Though comparatively *few* in number, met with under an infinite diversity of appearance, and in such abundance as to constitute the basis of the more solid parts of the globe.

Seldom if ever found free from foreign admixture : when purified artificially, distinguished by their want of *Tenacity*, *Fixity*, sparing *Solubility* in *Water*, *Inspidity*, want of *Odour*, incapacity

capacity of communicating a tinge to *Glass*, and their specific gravity not exceeding that of *Water* more than in the proportion of 5 to 1.

These characters possessed more perfectly by some of the earths than by others: hence their distinction into *saline* and *insipid*.

All the earths soluble in one or other of the *Acids*: cannot however be precipitated from their solutions, like the *Metals*, by *Prussiate* of *Potash* or of *Lime*.

Infusible even by the most intense degrees of *heat*, unless in a state of mixture; viz. with *each other*, with *Alkalies* or *other Salts*, or with *Metallic Oxyds*.

The earths at present known are, *Baryt*, *Strontian*, *Lime*, *Magnesia*, *Alumine*, *Silex*, *Zircon* or *Jargon Earth*, *Glucine*, *Yttria*, and *Aegistine*.

Of these *Lime*, *Alumine*, *Silex*, and *Magnesia*, by far the most abundant and useful.

Of Baryt, or Ponderous Earth.

Found in combination, 1st, with Carbonic Acid, *Carbonate* of *Baryt*; 2d. with Sulphuric

ric Acid (*Sulphate of Baryt, Baroselenite*); or, 3d. with Sulphuric Acid, Silex, Sulphate of Alumine, Sulphate of Lime, and Petroleum, (*Liver Stone*).

Obtained in a caustic or separate state, by exposing a mixture of *Carbonate of Baryt* and *Charcoal*, or *Nitrate of Baryt*, to a strong heat.

Colour *greyish*.—Taste *caustic*.—Specific gravity 4. 000.

Slakes like *Lime* on exposure to air, and imbibes water with avidity, forming with it a powerful cement.

Soluble in about 25 times its weight of cold, and in less than twice its weight of boiling water (*Barytic Water*), from which in cooling it crystallises in transparent prisms.

Imparts a lemon colour to the flame of *Alcohol*.

Unites with the *Sulphuric Acid* into a compound requiring for its solution 40,000 times its weight of *Water*.

With the *Nitric* and *Muriatic Acids*, forms crystallisable Salts.

On *Charcoal* melts, by the heat of the lamp, into liquid globules : melts also, with effervescence, both with *Microcosmic Salt* and *Borax*; but infusible when in mixture either with *Lime* or with *Magnesia*.

Unites

Unites with *Sulphur* into a species of *Hepar* (*Sulphuret of Baryt.*)

Order of attraction in the moist way, *Sulphuric Acid*, *Oxalic*, *Succinic*, *Fluoric*, *Phosphoric*, *Saccho-lactic*, *Suberic*, *Nitric*, *Muriatic*, *Sebacic*, *Citric*, *Tartareous*, *Arsenic*, *Formic*, *Lactic*, *Benzoic*, *Acetous*, *Boracic*, *Sulphureous*, *Nitrous*, *Carbonic*, and *Prussic*; *Sulphur*, *Phosphorous Water*, *Unctuous Oils*; in the dry way, *Phosphoric*, *Boracic*, *Arsenic*, *Sulphuric*, *Succinic*, *Fluoric*, *Nitric*, *Muriatic*, *Sebacic*, *Formic*, *Lactic*, *Benzoic*, and *Acetous Acid*; *Potash*, *Soda*, *Sulphur*, *Oxyd of Lead*.

The *Carbonate of Baryt* and other forms of this earth, remarkable for their violent effects, when exhibited internally.

Used principally as a test for ascertaining the presence of *Sulphuric Acid*.

Of Strontian.

Found either in combination, with carbonic acid, *Strontianite*; or with sulphuric acid, *Sulphate of Strontian*.

Best obtained in a separate or pure state from

Carbonate or *Nitrate* of *Strontian*, by exposing them to a strong heat, as in the preparation of *Baryt*, to which it is analagous in many of its properties.

Remarkable for the brilliancy of the flame which it exhibits when treated on charcoal by the blow-pipe; also for the red colour which it imparts to the flame of *Alcohol*.

The **order** of its attraction nearly the same with that of *Baryt*, though inferior to it in degree.

Of Lime, or Calcareous Earth.

Found 1st. uncombined, *Native Quicklime*; 2d. in union with Carbonic Acid and Water, *Calcareous Spar, Marble, Lime-stone, Chalk, &c.* 3d. with Carbonic Acid and Petroleum, *Swine-Stone*; 4th. with Carbonic Acid and Oxyd of Manganese, *Sidero-Calcite*; 5th. with Carbonic Acid and Carbonate of Baryt, *Baryto-calcite*; 6th. with Carbonic Acid, Carbonate of Magnesia, Iron, and Manganese, *Muri-Calcite*; 7th. with Carbonic Acid, Magnesia, Alumine, and Iron, *Schiefer Spar*; 8th. with excess of Carbonic

bonic Acid, Alumine, Magnesia, and Iron, *Dolomite*; 9th. with Fluoric Acid and Water, *Fluor*; 10th. with Phosphoric Acid, *Apatite*; and 11th. with Sulphuric Acid and Water, *Gypsum*, *Selenite*, *Plaster of Paris*.

Prepared for various purposes from *Carbonate of Lime*, by the continued application of a strong heat.

Form *concrete* or *powdery*. Taste *hot, pungent, caustic*. Specific gravity 2.3.

Soluble in about 5700 times its weight of water (*Aqua Calcis P. L.*) Changes vegetable blue colours to green.

On being suddenly moistened, emits both *Heat* and *Light*, losing at the same time its attraction of cohesion, *Slaked Lime*. The same takes place spontaneously on exposure to *Air*. On further exposure attracts Carbonic Acid from the Atmosphere; hence the increase of hardness observable in *calcareous Cements*.

Though infusible *per se*, promotes very powerfully the fusion of most of the other earthy Bodies: hence its use in working metallic ores, more especially those of *Iron*.

Melts with *Borax* and *Microcosmic Salt*,

without effervescence. Melts also with *Oxyd of Lead*.

Forms, with the *Sulphuric Acid*, a compound of little solubility in water, (*Gypsum*); with the *Nitric* and *Muriatic*, salts strongly deliquescent.

With *Sulphur*, a calcareous *Hepar*; with *Phosphorus* a liver coloured compound, which yields *Phosphorated Hydrogen Gas* on the affusion of water; with *unctuous substances*, peculiar *Soaps*.

Supposed in many instances to be of animal origin.

Order of attraction in the moist way, *Oxalic Acid*, *Suberic*, *Sulphuric*, *Tartareous*, *Succinic*, *Phosphoric*, *Saccho-lactic*, *Nitric*, *Muriatic*, *Sebacic*, *Fluoric*, *Arsenic*, *Formic*, *Lactic*, *Citric*, *Benzoic*, *Acetous*, *Boracic*, *Sulphureous*, *Nitrous*, *Carbonic*, and *Prussic*, *Sulphur*, *Phosphorous*, *Unctuous Oils*, *Water*; in the dry way, *Phosphoric*, *Boracic*, *Arsenic*, *Sulphuric*, *Succinic*, *Nitric*, *Muriatic*, *Sebacic*, *Fluoric*, *Formic*, *Lactic*, *Benzoic*, and *Acetic Acid*; *Potash*, *Sulphur*, *Oxyd of Lead*.

Used extensively as the basis of *Calcareous Cements*, *Plaster* and *Stucco*; in *Dying*, *Bleaching*, *Tanning*, *Sugar-baking*, and various other arts, besides its application in *Medicine*.

Of

Of Magnesia, or Muriatic Earth.

Found 1st. in union with Lime and some Iron, *Calci-murite*; 2d. with Silex, Alumine, Lime, Oxyd of Iron and Water, *Argillo-murite*; 3d. with Carbonic Acid, Silex and Iron, *Silici-murite*; 4th. with Silex and Alumine, *Talc*; 5th. with Silex, Alumine, Iron, and Carbonate of Lime, *Lapis Ollaris*; 6th. with Silex, Alumine, Iron, Air and Water, *Steatite*; 7th. with Silex, Iron, Carbonate of Lime, Alumine, Muriate of Magnesia, and Water, *Serpentine*; 8th. with Silex, Alumine, Lime, Iron, Air, and Water, *Chlorite*; 9th. with Carbonic Acid, Silex, Carbonate of Lime, Alumine, and Oxyd of Iron, in different proportions, *Asbestos*, *Amianthus*, *Suber montanum*, *Actynolite*, and *Jade*; 10th. with Silex, Lime, and Oxyd of Iron, *Baikalite*; 11th. with the Boracic Acid, Lime, Silex, Alumine, and Iron *Boracite*; and 12th with Sulphuric Acid, *Sulphate of Magnesia.*, *Epsom Salt*.

Prepared from a solution of this last, by the addition of *Carbonate of Potash*, and subsequent

exposure of the washed earthy precipitate to a strong and continued heat. (*Magnesia usta* P. L.)

Form *pulverulent*. Colour *pure white*. Taste *insipid*. Specific gravity about 2. 3.

Requires for its solution 7900 times its weight of water. Tinges vegetable blues of a light green.

Infusible without addition, even in the most intense degrees of heat, by which it is merely contracted in its dimensions; but melts into a glass with *Lime*, *Microcosmic salt*, or *Borax*, or with a mixture of *alumine* and *silica*.

Unites with all the Acids. With the *Sulphuric Acid* regenerates *Sulphate of Magnesia* (*Magnesia Vitriolata* P. L.) With *Carbonic Acid*, Carbonate of Magnesia (*Magnesia Alba* P. L.)

May be combined, in small proportions, with *Sulphur*.

Order of Attraction in the moist way *Oxalic Acid*, *Phosphoric*, *Sulphuric*, *Fluoric*, *Sebacic*, *Arsenic*, *Saccho-lactic*, *Succinic*, *Nitric*, *Muriatic*, *Tartareous*, *Citric*, *Formic*, *Lactic*, *Benzoic*, *Acetous*, *Boracic*, *Sulphureous*, *Nitrous*, *Carbonic*, and
Prussic,

Prussic, Sulphur, Phosphorus, Water; in the dry way, *Phosphoric, Boracic, Arsenic, Sulphuric, Fluoric, Sebacic, Succinic, Nitric, Muriatic, Formic, Lactic, Benzoic and Acetic Acid*; *Potash, Sulphur, Oxyd of Lead.*

In common use in disorders of the *Primæ Viæ* as an *antacid* and *laxative*, and in the form of steatite as an ingredient in the Manufacture of the finer kinds of *Pottery*.

Of Alumine, or Argillaceous Earth.

Found united to, 1st. Carbonic Acid and Lime, *Lac Lunæ*; 2d. to Silex, *Clay*; 3d. to Silex, Carbonate of Lime, Carbonate of Magnesia, Oxyd of Iron, Air and Water, in different proportions, *Lithomarga, Fuller's Earth* and *Bole*; 4th. to Silex and Iron, *Tripoli*; 5th. to Silex, Oxyd of Iron, Manganese, Water and Air, *Lepidolite*; 6th. to Silex, Magnesia, Iron and Lime, in different proportions, *Sapari, Hornblende, and Basalt*; 7th. to Silex, Magnesia,

fia, and Oxyd of Iron, *Mica*; without Magnesia, *Micarelle*; 8th. to Silex, Iron, and Carbonate of Lime, *Calp*; 9th. to Silex, Magnesia, Iron, and Petroleum, *Argillaceous Schistus*; and 10th. to Sulphuric Acid, *Sulphate of Alumine*.

Obtained in its purest form from a solution of *Sulphate of Alumine*, by the addition of *Potash*, *Soda*, or *Ammoniac*; hence its present denomination.

Form *powdery*. Colour, when dry, *pure white*. Feel *unctuous*. Taste *insipid*. Smell when breathed on, *earthy*. Specific gravity 2.

Insoluble in *Water*. When moistened becomes plastic, and contracts and hardens when exposed to the higher degrees of *Heat*; therefore the basis of the different kinds of *Pottery*. After baking is no longer capable of becoming plastic.

Soluble in the humid way by *Alkalies*.

Fusible, with effervescence, both with *Microcosmic Salt*, and *Borax*, fusible also with *Lime*.

Combines with most *Acids*, though with difficulty, except under precipitation, and produces with them compounds which are more or less

less astringent. The most important of these, the *Sulphate of Alumine* or common *Alum*, prepared from the decomposition of *Argillaceous Schistus*. This properly a triple, sometimes a quadruple, salt. Form of its crystals *octohedral*. Taste *astringent*. Soluble in about 14 times its weight of cold, and somewhat more than an equal weight of boiling water. Undergoes watery fusion, and parts with its water of crystallization, on exposure to *Heat* (*Alumen Ustum* P.L.) When calcined with certain inflammable substances, as yolk of egg, or sugar, produces a compound, which takes fire spontaneously on exposure to *Air* (*Pyrophorus* of *Homborg*.)

Has of all the *Earths* the greatest attraction for *Metallic Oxyds*; has also a strong attraction both for *Silex* and *Magnesia*.

Order of Attraction of *Alumine* in the moist way, *Sulphuric Acid*, *Nitric*, *Muriatic*, *Oxalic*, *Arsenic*, *Fluoric*, *Sebacic*, *Tartareous*, *Succinic*, *Saccho-lactic*, *Citric*, *Phosphoric*, *Formic*, *Lactic*, *Benzoic*, *Acetous*, *Boracic*, *Sulphureous*, *Nitrous*, *Carbonic*, and *Prussic*; in the dry way, *Phosphoric*, *Boracic*, *Arsenic*, *Sulphuric*, *Nitric*, *Muriatic*, *Fluoric*, *Sebacic*, *Succinic*, *Formic*, *Lactic*,
Benzoic,

Benzoic, and Acetic Acid; Potash, Sulphur, Oxyd of Lead.

Uses, comprehending those of Sulphate of Alumine, *Dying, Tanning, Printing, Silvering, Painting, Pottery, Medicine, &c.*

Of Silex.

Found in union, 1st. with Alumine, Lime, and Iron, as in most of the *precious Stones, Hyalite and Prehnite*; 2d. with Alumine only, *Schorlite, and Calcedony*; 3d. with Alumine and Iron, *Olivin, Elastic Quartz, Obsidian, Opal, Pitch-stone, Hornslate, Jasper, and Argentine Felspar*; 4th. with Alumine, Lime, Magnesia and Iron, *Schorl, Thumerstein and Siliceous Spar*; 5th. with Alumine, Iron and Manganese, *Rubellite*; 6th. with Alumine and Lime, *Quartz, Flint, Hornstone, and Ædelite*, and with water *Zeolite*; 7th. with Oxyd of Nickel, Lime, Alumine, and Oxyd of Iron, *Chrysoprase*; 8th. with Lime, Magnesia, Iron and Coal, *Silicious Schistus*;

Schistus ; 9th. with Alumine, Lime, Sulphate of Baryt, Magnesia, and Iron, *Adularia* ; without Iron, *Felspar* ; 10th. with Alumine, Sulphate of Lime and Oxyds of Copper and Iron, *Labrador Felspar* ; 11th. with Alumine, Baryt and Water, *Staurolite* ; and 12th. with Lime, Sulphate of Lime and Iron, *Lapis Lazuli*.

May be separated from most of these by digestion in *Nitric Acid*, and further purified by fusion with either of the fixed alkalies, and redigestion in the nitric or any other of the stronger acids.

Colour *white*. *Inspid*. *Dry* to the touch. Sparingly if at all soluble in *Water*. Specific gravity 2.66. *Infusible*.

Soluble in the *Fluoric*, but in no other acid.

Soluble also in the solution of either of the *fixed Alkalis*, by the assistance of heat. Precipitates and combines with lime on being added to lime water ; unites too in the humid way with some of the metallic oxyds.

May be fused with *Lime*, *Microcosmic Salt*, or *Borax* ; but much more readily with *Potash* or *Soda* : hence the preparation of the different kinds of *Glass*.

When

When melted with a large proportion of *Alkali*, forms a deliquescent compound, (*Liquor Silicum*,) the decomposition of which by an *Acid*, furnishes a gelatinous precipitate, thought to be soluble in about 1000 parts of *Water*.

Order of Attraction in the moist way, *Fluoric Acid*, *Potash*; in the dry way, *Potash*, *Boracic Acid*, *Phosphoric Acid*, *Oxyd of Lead*.

Used principally in *Polishing*, *Painting*, and *Glass-making*.

Of Zircon, or Fargon Earth.

Combined with silica, iron, and nickel in the stone called *Fargon* or *Zircon*: found also in the *Hyacinth*.

Obtained from these by fusion with potash, and subsequent solution in, and precipitation from the *Muriatic Acid*.

Colour, *white*. Insoluble in water; when moist, *semi-transparent*. Specific gravity estimated at 4. 300.

When heated in contact with charcoal, is imperfectly

perfectly vitrified, and becomes of sufficient hardness to strike fire with steel.

Resembles *Silex* in its action on *Metallic Oxyds*, and *Alumine* in forming astringent compounds with the *Acids*: but differs from both in being insoluble in the *Fixed Alkalies*.

Order of its attraction as yet unknown.

Of Glucine.

Obtained by the analysis of *Aquamarine*, the *Beryl*, and the *Emerald*.

Colour, *white*. *Insipid*. *Insoluble* in water. *Adhesive* to the tongue. *Infusible per se*; but melts with *Borax* into a transparent *Glass*.

Soluble in most of the *Acids*, and likewise in the solutions of the *fixed Alkalies* and of *Carbonate of Ammonia*.

Its *saline* compounds slightly astringent, and of a *sweet taste*: hence its name.

Its *Sulphate* remarkable for giving a yellowish
white

white precipitate on the addition of *Infusion of Gall Nuts*.

Its affinity for *Acids* intermediate between that of *Magnesia* and of *Alumine*.

Yttria.

Found in the *Gadolinite*, a Swedish stone, so called from this earth being discovered in it by *M. Gadolin*.

Colour of this earth *pure white*—Without taste or smell—*Infusible*—With *Borax* melts into a white transparent glass—Soluble in *Carbonate of Ammonia*, though not in either of the *caustic fixed Alkalies*.

With the *Sulphuric, Nitric, Muriatic*, and with other acids, forms compounds remarkable, like those of *Glucine*, for their astringency and sweetness, to which earth it is considered in many respects as analogous, though in others essentially different.

Agustine.

Discovered by *M. Trommsdorff* in the *Beril of Georgenstadt*.—When pure resembles *Alumine*—

mine—Is insoluble in *Water* and not affected by *Alkalies*, whether pure or carbonated, even by the assistance of heat—Unites readily with *Acids* with which it forms compounds having little or no taste, and on this account has received its name.

Of METALS.

Found generally in the clefts or fissures of stony or other strata, forming what are called *Metallic Veins*; or in indeterminate *Masses*; or in *Beds*; or *desseminated* through other substances.

In these instances they are either *native*; or *alloyed* with each other; or in different states of *Oxydation*; or *mineralized* with certain combustible bodies, particularly *Sulphur*; or lastly, combined with one or other of the *Acids*.

Different processes therefore commonly necessary for obtaining them in their separate and

proper forms ; as, *Pounding, Washing, Roasting, Amalgamation, Reduction, and Refinement.*

When pure, easily distinguished from other bodies by their united properties of *Weight, Opacity and Splendour*, as well as by their power of conducting the *Electric and Galvanic Fluids.*

Some remarkable for their *Ductility*, or *Malleability*, or both ; others for their comparative *Brittleness* : hence the *common* though *inaccurate* distinction into *Metals* and *Semi-metals.*

Differ also from each other in their comparative *Hardness* and *Softness* : when hardened by mechanical extension, may be made soft again by exposure to a red heat—*Annealing.*

All *fusible* in close vessels if heated to their respectively necessary degrees ; are convex when in fusion, and in cooling disposed to *crystallise.*

Some, particularly *Iron* and *Platina*, grow soft before they melt, and hence are capable of being united by the operation of *Welding.*

Some, as *Platina, Gold* and *Silver*, remain *fixed* during fusion ; others, as *Quicksilver, Arsenic, Zinc* and *Antimony* are *volatile* or convertible into a state of *Vapour.*

Variously

Variously affected on exposure to *Air*, by which in some instances they are merely *tarnished*, in others deprived of their metallic properties more completely, being converted into a state of *Oxyd*: hence the utility of *Tinning*, *Silvering*, *Gilding*, &c.

All, except *Piatina*, *Gold* and *Silver*, still more readily *oxydated* by the united action of *Air* and *Heat*; hence their division into *Noble* and *Base* metals. The circumstances in which these differ from each other in their *Oxydation* are; the comparative facility with which they become *oxydated*, the temperature required for that purpose, the quantity of *Oxygen* which they respectively imbibe, the force with which they afterwards retain it, and the phenomena which they present during *Oxydation*.

Of *perfect* and *imperfect* metallic oxyds.

Metallic Oxyds, however produced, vary in their properties, not only from each other, but also from their respective metals. Those of the volatile metals much more fixed than the metals themselves:—Some capable of being decomposed or deprived of their *Oxygen* by heat alone, as those of *Platina*, *Gold*, *Silver*

and *Quicksilver*—Such as are not decomposed by the simple application of heat are *vitriifiable*; hence the necessity of *Fluxes*.

Remarkable for the *Colours* and sometimes for the *Opacity* which they communicate to *Glass*: hence the preparation of *Pastes* in imitation of precious stones, and also the preparation of *Enamels*.

Few of the *Metals* at a common temperature have any considerable action upon *Water*, in general therefore void of *Taste*; some however when aided by a red heat readily decompose it, and are thereby converted into *Oxyds*: hence the explanation of their effects on various other fluids.

Previous *Oxydation* necessary to their combination with acids (*Metallic Salts*.) Hence, in their solution, the partial decomposition of the *Acid* itself, or of the *Water* by which it is diluted; and the consequent evolution of *Sulphureous*, *Nitrous* or *Hydrogen* gas.

In some instances they are furnished with so large a proportion of *Oxygen* as to become *insoluble*, in others acidified. (*Acid of Arsenic*, of *Molybdena*, &c.)

Metallic

Metallic Salts for the most part possessed of *Colour* and more or less *Corrosive*.

The *Acidifiable Metals*, and those, the *Oxyds* of which have a disposition to combine with *Earths* and *Alkalis*, may be readily *oxydated* by these through the medium of *Water*.

Many *Metallic Oxyds* soluble in solutions of the *Alkalis*, forming with them permanent compounds. The partial decomposition of the *Oxyd* by the *Alkali* sometimes necessary to this.

Neutral Salts acted on slowly by *Metals* unless aided by *heat*, which, by assisting to decompose their acids, *oxydates* the metal and renders it combinable with the *Alkali*.

Metallic Oxyds already formed sometimes combine with *Neutral Salts*, and produce with them triple compounds.

Iron the only metal capable of combining with *Charcoal*; but this, and almost all the others, or their *Oxyds*, unite readily with *Sulphur*, their common mineralizer: many also combine with *Phosphorus*, and form fusible compounds.

With very few exceptions they unite with each other by fusion in all proportions.

The

The metals at present known are the following ; *Platina*, *Gold*, *Silver*, *Quick-silver*, *Lead*, *Copper*, *Iron*, *Tin*, *Bismuth*, *Nickel*, *Arsenic*, *Cobalt*, *Zinc*, *Antimony*, *Manganese*, *Wolfram*, *Uranium*, *Molybdena*, *Titanium*, *Tellurium*, *Chrome* and *Columbium*. *Potassium* *Sodium*

Of *Platina*. *Palatinate*

Brought from *South America*, in small grains of a dull silver colour, and commonly mixed with *Quick-silver*, *Ferruginous Sand*, and particles of *Native Gold*. Found also sometimes, though rarely, in lumps — Bed and matrix unknown.

Manner of purifying, by fusion with *Phosphorus* ; or amalgamation with *Quick-silver*, and solution in *Oxy-muriatic Acid* — Wrought in the large way by repeatedly melting with *Arsenic* and *Potash*, and subsequent roasting and hammering.

When pure, of a *Silver white* colour, inclining to *Iron-grey*.

Malleability

Malleability and *Ductility* intermediate between those of *Gold* and *Silver*—*Hardness* greater than that of either—*Tenacity* next to *Copper*—*Specific Gravity* from 20,850 to 24,000, according to the degree of compression.

Extremely difficult of *Fusion*; but when urged by an intense heat, becomes capable of being *welded*, though imperfectly.

Less disposed to *tarnish* than either *Gold* or *Silver* on exposure to air—and not *Oxydable* by it even under the strongest heat; but may be reduced to a powdery *Oxyd* by the *Electrical Spark*.

Soluble only in the *Nitro* and *Oxy-muriatic Acids*, to which it communicates at first a *yellow*, and afterwards a deep *reddish brown* colour.

Precipitable from its solutions in these by the *Alkalis* and several of their compounds—With *Muriate* of *Ammonia*, as with many of the others, it forms a *Triple Salt*, which on being submitted to an intense heat, furnishes the pure *Metal*.—Precipitable also by many of the other metals and their solutions, more especially by *Tin*.

In

In its metallic state is not acted on, in the dry way, by *Earths* or *Alkalis*, or any of their compound salts, except the *Nitrate* and *Oxy-muriate* of *Potash*, by which it is superficially oxydated.

Has no affinity with *Sulphur*; but, like *Gold*, is soluble in *Alkaline Sulphurets*—Combines readily with *Phosphorus*.

When pure, amalgamates intimately with *Quick-silver*, and unites by fusion, in different proportions, with most of the other *Metals*—most easily with *Zinc*—with *Copper* produces a golden coloured, hard and durable compound, which is malleable, close grained, and susceptible of a fine polish—remarkable for giving a considerable degree of toughness to *Cast Iron*. With *steel* forms a compound incapable of being touched by the file.

Order of attraction, in the moist way, *Æther*; *Muriatic*, *Oxy-muriatic*, *Nitric*, *Sulphuric*, *Arsenic*, *Fluoric*, *Tartareous*, *Phosphoric*, *Sebacic*, *Oxalic*, *Citric*, *Formic*, *Lactic*, *Acetic*, and *Succinic Acids*; in the dry way, *Arsenic*—*Gold*—*Copper*—*Tin*—*Bismuth*—*Zinc*—*Antimony*—*Nickel*—*Cobalt*—*Manganese*—*Iron*—*Lead*—*Silver*—*Quick-silver*—and *Sulphuret* of *Potash*.

Use

Use as yet, principally confined to *Chemical* and *Philosophical* purposes.

Of Gold.

Though less abundant, yet occurs more generally than most of the other *Metals*.

Found, either alloyed with a small proportion of Silver, Copper, Iron—*Native Gold*; or, combined with Sulphur, Antimony, Arsenic, Lead, Iron and Silver—*Grey Gold Ore*; or, with Bismuth and Sulphur—*White Gold Ore*—*Aurum Graphicum*.

Manner of collecting it from its ores.

When pure, of a *bright yellow* colour; *soft*; *inelastic*; *flexible*; very *tough*; *ductile* and *malleable* to an extraordinary degree; not *sonorous*.

Next to Platina the *heaviest* of the metals; its specific gravity when uncompressed being 19. 30.

Scarcely *tarnishes* even by continued exposure to air or moisture.

Melts

Melts soon after becoming red hot, or at 32° Wedgw.—5237 Farenht.—Whilst in fusion, of a *sea green* colour.

Though unalterable in the common fire, may, by a more intense degree of heat, be *volatilized*, or imperfectly *oxydated*.

Crystallises in cooling, into quadrangular pyramids.

If fused by the lowest degree of heat required for that purpose, becomes afterwards *brittle*—becomes also *hard* and *brittle* by compression: hence the necessity of *Annealing*.

In the form of Gold leaf, is converted by *Electrical Explosions* into a *purple Oxyd*; and when ignited by the *Galvanic Fluid*, burns with *vivid white* flame, inclining to *blue*.—Said also to be capable of being *inflamed* when plunged into concentrated *Oxy-muriatic acid Gas*.

Like Platina, *soluble* only in the *Oxy* and *Nitro-muriatic Acids*, without effervescence; and in the solutions of *Alkaline Sulphurets*—Its acid solutions of a *yellow* colour and *caustic*, stain the skin *purple*, and, when evaporated, yield deliquescent crystals, which like the oxyds of this metal are decomposed by simple heat.

Gold

Gold separable from its solutions by *Æthers*, *Essential Oils*, *Phosphorus*, *Hydrogen Gas*, *burning Sulphur*, &c. May likewise be precipitated by all the *Alkalis*, and *Earths* in the form of a *yellow Oxyd*, which by exposure to light is partially decomposed, and becomes of a *purple* colour, and no longer soluble in acids.

The precipitate by *Ammonia* long known for the property of exploding with great violence when exposed to a moderate heat (*Aurum Fulminans*.)—This an *Ammoniacal Oxyd*, the explosive power of which depends on the double decomposition which takes place between the *Oxyd* and the *Ammoniac*; hence the effects of exposing *Aurum Fulminans* to a gentle heat, or of mixing it with *Oil* or *Sulphur*, or of heating it under strong *Compression*.

The precipitate of Gold by *Tin*—(*Purple Powder of Cassius*,) proved by the experiments of *Pelletier* to be an intimate mixture of *Oxyd* of *Tin* with imperfect *Oxyd* of *Gold*.

Gold distinguishable from *Platina*, by being precipitable from its solution by *green Sulphate of Iron*; but not by *Muriate of Ammonia*.

Its *Oxyds* unite by means of *Alkalis* with the *vitriifiable Earths*.

Has

Has no affinity in its metallic state, for either *Sulphur* or *Carbon*; but unites with a small proportion of *Phosphorus*, and thereby becomes *paler*, and more *fusible*.

Combines with all the *Metals* in various proportions, acquiring different shades of colour and hardness, according to the quantity of alloy.

With *Copper* assumes a deeper colour and becomes more fusible, harder, and more elastic.

Amalgamates readily with *Quick-silver*; hence the art of water-gilding, and manner of collecting it from its ores, as before mentioned.

May be freed from admixture of imperfect metallic matter, by fusion with *Lead*, or *Bismuth* under free access of air; hence the process of Cupellation.

Most easily and effectually separated from *Silver* by diluted *Nitric Acid*.

Order of attraction; in the moist way, *Æther*, *Muriatic*, *Oxy-muriatic*, *Nitric*, *Sulphuric*, *Arse-nic*, *Fluoric*, *Tartareous*, *Phosphoric*, *Sebacic*, and *Prussic Acid*, *Potash*, *Ammoniac*; in the dry way, *Quick-silver*, *Copper*, *Silver*, *Lead*, *Bismuth*, *Tin*, *Antimony*, *Iron*, *Platina*, *Zinc*, *Nickel*, *Arse-nic*, *Cobalt*, *Manganese*, *Sulphuret of Potash*.

Used

Used extensively in the construction of *Uten-
sils*, and different kinds of *Ornaments*; in *Ena-
melling*, *Gilding*, *Dying*, *Soldering*, &c.

Of Silver.

Found, 1st. united to a small proportion of Gold, Copper, or Iron, *Native Silver*.—2^d. in alloy with Antimony, or with Antimony, Arsenic and Iron—*Antimoniated* and *Arsenical Silver Ores*; 3^d. mineralized by Sulphur—*Vitreous Silver Ore*; 4th. combined, in the state of oxyd, with oxyd of Antimony and Sulphur—*Red Silver Ore*; 5th. with Lead, Sulphur, Antimony, Iron, Alumine and Silex—*White Silver Ore*; 6th. with Muriatic Acid, Oxyd of Iron, Alumin, and a little Sulphuric Acid—*Horn Silver Ore*.

Manner of extracting it from its ores.—Purified by *Cupellation* or reduction from *Muriate of Silver*.

Colour

Colour *white*—has neither *Smell* nor *Taste*—is less *ductile* and *tenacious* than Gold; but *harder*, more *splendid* and more *opaque*—*Elasticity* between Gold and Copper—very *sonorous*—*Specific Gravity* from 10,253 to 11,091.

Tarnishes on exposure to air, and becomes occasionally encrusted with *Sulphuret of Silver*.

Melts below a white heat, or at 28 *Wedgw.* = 4717 *Farenh.* Is very *brilliant* when in fusion—and in cooling, *crystallises* into quadrangular pyramids or octahedrons.—By intense heat may, like Gold, be *volatilized* and partially *oxydated*.

By *electrical explosions* is converted into an *Oxyd* of a greenish grey colour—by the *Galvanic Fluid* burns with an *emerald-green* flame.

Its *Oxyds* decomposeable by *Heat* alone.

Most readily *soluble* in *Nitric Acid*—the solution *bitter* and *corrosive*—stains the skin and other animal substances *black*.

Upon evaporation yields a *crystallisable* salt, susceptible of watery fusion (*Argentum Nitratum P. L.*) Yields a *Metallic Precipitate* to many of the other *Metals*, as also to *Phosphorus*, burning *Charcoal*, burning *Sulphur*, &c.—and

an

an *Oxyd* of silver to the *Fixed Alkalis* and *Earths*.—With *Ammonia* forms a triple compound still more remarkable for its fulminating property than that of *Gold* (*Argentum Fulminans*.) Manner of preparing this—and causes of failure.

Silver also soluble in Nitro-Sulphuric Acid (*Aqua Regina* of *Keir*.)

And in the common *Sulphuric Acid* by the assistance of a boiling heat.

Although slightly or not at all acted on by the other *Acids*, many combine readily with its *Oxyd*; hence the decomposition of *Nitrate of Silver* by *Muriatic* or *Oxy-muriatic Acid*, and their compounds, and the consequent formation of *Muriate of Silver* (*Luna Cornea*.) This remarkable for its easy *Fusibility*, *Insolubility* in water, and becoming *dark coloured* on exposure to *Light*, which produces a change of colour, equally striking, in *Chromate of Silver*.

Silver, in its *metallic state*, not combinable either with *Alkalis* or *Earths*, or with any of their saline compounds.

In the state of *Oxyd* it communicates a *yellowish olive* or *brown* colour to glass.

Unites

Unites in various proportions with most of the other *Metals*, and with all the other *combustible Bodies*, *Carbon*, *Azote* and *Hydrogen* excepted.—Loses its *Ductility* by combination with *Tin*, and with *Copper*, its usual alloy, becomes *harder* and more *sonorous*.—Forms a *dark violet coloured mass* with *Sulphur*.—With *Phosphorus* becomes more *fusible* and *brittle*.

Order of attraction in the moist way, *Muriatic*, *Sebacic*, *Oxalic*, *Sulphuric*, *Saccho-lactic*, *Phosphoric*, *Nitric*, *Arsenic*, *Fluoric*, *Tartareous*, *Citric*, *Formic*, *Lactic*, *Acetous*, *Succinic*, *Prussic*, and *Carbonic Acids*, *Ammonia* ; in the dry way, *Lead*, *Copper*, *Quick-silver*, *Bismuth*, *Tin*, *Gold*, *Antimony*, *Iron*, *Manganese*, *Zinc*, *Arsenic*, *Nickel*, *Platina*, *Sulphuret of Potash*, *Sulphur*.

Used in the construction of various *Utensils* ; in the composition of *Bell-metal* ; in *Silvering*, *Enamelling*, *Soldering*, *Dying*, *Medicine*, &c.

Of Quicksilver.

Found chiefly either in a *Native State*; or alloyed with silver, *Native Amalgam*; or in union with muriatic and sulphuric acids, *Horn Mercury*; or minerallised by sulphur, *Native Cinnabar*.

Manner of obtaining it from its ores, and of ascertaining its purity. Freed most effectually from foreign admixture by cautious distillation.

When pure, of a *silver white* colour, *brilliant*, *fluid* at a common temperature, specific gravity 13.568.

Congeals at 39 below 0 *Farenh.* and then found to be malleable.

In its liquid form attracts moisture on exposure to the atmosphere, loses its splendor and contracts a grey pellicle. By agitation with access of air or trituration with mucilage or other tenaceous substances, is converted into a *greyish* or *black Oxyd*: hence the more common preparations of quicksilver, viz. *Pilul, Hydrarg.* P. L. *Unguent. Hydrarg.* P. L. *Emplast. Litharg. cum Hydrarg.* P. L. &c.

Passes from its liquid state into that of vapor in vacuo even at a common temperature; but

F under

under atmospherical pressure, requires to be heated to 600 *Farenh.*

If continued under exposure to air at this temperature, is converted into a sparkling *red Oxyd*, containing a larger proportion of *Oxygen* than that obtained by trituration, (*Hydrarg. Calcinat. P. L.*) Of the chemical properties of this oxyd.—When exposed to a red heat in close vessels it is decomposed, yielding pure *Oxygen Gas*, and the original *Metal*.

Quicksilver acts either directly or indirectly on all the *Acids*.

Partially decomposes and combines with the *Sulphuric Acid* by the assistance of heat. Produces with it a white ponderous saline mass, which on the affusion of boiling water assumes a *lemon yellow* colour, (*Hydrarg. Vitriolat. P. L.*) The change of colour thought to depend upon the abstraction of a portion of the undecomposed acid.

Dissolves in the *Nitric Acid* more or less readily, and with a more or less copious evolution of *Nitrous Gas*, according to the temperature and strength or dilution of the acid, *Nitrate of Quicksilver*.—This exposed to a low red heat, by a further and more complete decomposition of the acid, yields a red *Oxyd*,
(*Hydrarg.*

Hydrarg. Nitrat. Rubr. P. L.) Analogous in all its properties to the *Hydrarg. Calcinat.* or common *Oxyd.*

Has no action on the common *muriatic acid*, unless previously oxydated; but with the *Oxygenised Acid* combines with great facility and without effervescence: hence the preparation of *Muriate of Quick-silver*, (*Hydrarg. Muriat. P. L.*) and of *mild Muriate of Quicksilver*. (*Hydrarg. Muriat. Mit. P. L.*).—

Of the processes employed for obtaining these as well in the moist as in the dry way—Proofs that their difference consists in the quick-silver being in the one so much more *oxydated* than in the other.

Of the combination of *Oxyd* of quick-silver with the *Acetic* and other *Acids*. (*Hydrarg. Acetat. &c.*)

The acid solutions of this, like those of other *Metals*, decomposed by *Alkalies* and *Alkaline Sulphurets*, and by most of the *Earths*. The degree of previous *Oxydation* indicated by the colour of the resulting precipitates: those by *Potash* and *Soda* are of a yellow or reddish brown; those by *Ammonia* of a grey or white colour, (*Hydrarg. Præcipit. Alb. P. L.*) *Ammoniacal Muriate of Quicksilver*, FOURCROY.

Zinc, Iron and Copper precipitate *Quick-silver* from its solutions in its *metallic* form; a similar effect produced, though slowly, by *Phosphorus*. — *Alcohol*, added to the solution of *Nitrate of Quick-silver*, and assisted by heat, furnishes a precipitate, which when dried and heated, explodes with great violence, *Howard's Fulminating Mercury*.

Quick-silver amalgamates with most other *Metals*; very readily with *Gold, Silver, Lead, Tin, Zinc* and *Bismuth*; less easily with *Platina, Copper* and *Arsenic*, and difficultly, if at all, with *Iron*.

Combines by different *Modes* and, as was supposed, under different degrees of *Oxydation*, with *Sulphur*. By fusion and subsequent trituration, or by trituration simply, into a ponderous black powder (*Hydrarg. cum Sulph. P. L.*), *Æthiop's Mineral*; and by fusion and sublimation into a red striated mass (*Hydrarg. Sulph. Ruber, P. L.*), *Vermillion. Artificial Cinnabar*. Which may also be prepared by double decomposition, from a mixture of *Muriate of Quicksilver* and *Sulphuret of Antimony, Cinnabar Antimonii*.

Preparations

Preparations analogous to the former procurable, by agitating *Quick-silver* in solutions of *Alkaline Sulphurets*.

Order of attraction in the moist way, *Sebacic, Muriatic, Oxalic, Succinic, Arsenic, Phosphoric, Saccho-lactic, Tartareous, Citric, Nitric, Fluoric, Acetous, Boracic, and Carbonic Acids*; in the dry way, *Gold, Silver, Platina, Lead, Tin, Zinc, Bismuth, Copper, Antimony, Arsenic, Iron, Alkaline Sulphurets, Sulphur*.

Uses, in the construction of *Philosophical Instruments and Mirrors*, in *Gilding*, in working the *Ores of Gold and Silver*, making *Anatomical Injections*, and in *Medicine* in all the foregoing forms.

Of Lead.

Found 1st. (though very rarely,) *Native*; 2d. in union with sulphuric acid, *Native Sulphate of Lead*; 3d. with acid or oxyd of arsenic, *Arsenical Lead Ores*; 4th. with phosphoric acid, *Native Phosphate of Lead*; 5th. with molybdic acid, carbonate of lime and filex, *Carinthian Molybdate*

Molybdate of Lead; 6th. with chromic acid, *Red Lead Ore of Siberia*; 7th. with carbonic acid, *Sparry Lead Ore*; 8th. with sulphur and a little silver, *Potter's Lead Ore, or Galena*; 9th. with antimony and a little silver, *Antimonial Lead Ore*.

Manner of extracting it from its Ores.

Colour, blueish white—*lustre*, considerable—*soft*—*flexible*—*inelastic*—of little *tenacity*—not *sonorous*—*Spec. Grav.* 11,352—more *malleable* than *ductile*—does not become *harder* or of greater *Density* by compression—emits a particular *Smell* on friction.

Loses its lustre readily on exposure to *Air*, becoming first of a dull grey colour, and afterwards *whitish*.

Melts at 540 *Farenh.* and if cooled slowly crystallises into quadrangular pyramids. Heated more intensely, it boils and emits fumes; if under exposure to air, it passes readily into a state of *Oxyd*, and assumes different colours, according to the degree of oxydation: hence *Massicot*, *Minium* and *Litharge*. These and all the other oxyds of lead easily vitrified, *Glass of Lead*; and this easily decomposed, if heated, with the addition of *Charcoal*.

Lead

Lead in its metallic state little affected, either by the *Sulphuric* or *Muriatic Acid*, but dissolves readily in the diluted *Nitric Acid*, and forms with it a crystallizable salt.

Exposed to the vapour of the *Acetous Acid*, it is converted into a laminated white oxyd, *Flake White* (*Cerufs A. P. L.*), which, dissolved in a further portion of this acid, produces a crystallizable astringent salt, remarkable for its sweetness, *Sugar of Lead*, (*Cerufs. Acetat. P. L.*). (*Aq. Litharg. Acetat. P. L.*).

When highly oxydated, as by treatment of its red oxyd by *Nitric* or *Oxy-muriatic Acid*, forms a *brown* precipitate, which enflames without detonation when strongly triturated with *Sulphur*.

Is precipitated from its solutions of a *white* colour by *Alkalies* and by *Earths*, and of a *dark brown* by *Alkaline Sulphurets* and *Sulph. Hydrog. Gas*. Its solutions also decomposed by the *Sulphuric*, *Muriatic* and *Phosphoric Acids*, and their compounds.

May be oxydated by deflagration with *Nitre*, and by fusion with the *Fixed Alkalies* becomes soluble in water.

Unites

Unites by fusion with most of the metals, viz. with *Platina*, *Gold*, *Silver*, *Copper*, *Tin*, *Bismuth*, &c. Amalgamates readily with *Quick-silver*, but refuses to combine with *Iron*.

Melts with *Sulphur* into a grey coloured brittle compound, less fusible than itself, *Artificial Galena*; with *Phosphorus* into one which is malleable, but more disposed to tarnish.

The *Oxyds* of *Lead* soluble in *Expressed Oils* and *Animal Fats*: hence the preparation of certain *Plasters*, *Varnishes* and *Paints*; are capable also of decomposing several of the compounded *Salts*, (*Patent Yellow*); and remarkably promote the vitrification of earthy bodies and other metallic oxyds, as in *Glass-making*, and in the *Refinement of Gold and Silver*.

Order of attraction in the moist way, *Sulphuric*, *Sebacic*, *Saccho-lactic*, *Oxalic*, *Arsenic*, *Tartareous*, *Phosphoric*, *Muriatic*, *Nitric*, *Fluoric*, *Citric*, *Formic*, *Lactic*, *Acetous*, *Boracic*, *Prussic* and *Carbonic Acid*, *Potash*; in the dry way, *Gold*, *Silver*, *Copper*, *Quick-silver*, *Bismuth*, *Tin*, *Antimony*, *Platina*, *Arsenic*, *Zinc*, *Nickel*, *Iron*, *Alkaline Sulphurets*, *Sulphur*.

Employed in *Medicine*, and very extensively in the *Arts*, particularly in the construction of
Buildings,

Buildings, and different Utensils ; in the making of Shot, in Statuary, Glass-making, Glazing, Painting, Varnishing, Refinement of Gold and Silver, Composition of Pewter, and Plumber's Solder, &c. &c.

Of Copper.

Found 1st *Native* ; 2d. combined with oxygen and sometimes with iron, *Tile Ore*, *Pitch Copper Ore* ; 3d. with carbonic acid, *Green* and *Azure Copper Ores* ; 4th. with arsenic acid, *Arseniate of Copper* ; 5th. with sulphuric acid, *Sulphate of Copper* ; 6th. with muriatic acid, *Muriate of Copper* ; 7th. with sulphur, *Vitreous Copper Ore* ; 8th. with sulphur and iron, *Yellow Copper Ore* ; 9th. with arsenic and iron, *White Copper Ore* ; and 10th. with lead, antimony, iron, sulphur, alumine, filex and silver, *Grey Copper Ore*.

Manner of *extracting* it from its ores, and of *purifying* it.

Colour, bright brownish red—*taste*, nauseous styptic — *odour*, when rubbed disagreeable—
hardness,

hardness, somewhat greater than that of *Gold* or *Silver*—*Malleability*, *Ductility* and *Tenacity* considerable—*Sp. Gr.* if soft 7.788, if compressed nearly 9—when hard, *elastic* and *sonorous*.

On exposure to *Air* loses its lustre and contracts a greenish rust: in the *open Fire* is converted into a dull brownish red or black *Oxyd*, which heated to redness with *Filings* of *Copper*, assumes an orange colour.

Fuses at 27° *Wedw.* = 4587 *Farenh.* and if heated more intensely is *volatilised* in fumes.—In cooling slowly *crystallises* into quadrilateral pyramids.

Is more or less acted on by all the *Acids*.

Dissolves with the assistance of a boiling heat in concentrated *Sulphuric Acid*, and affords transparent oblong rhomboidal crystals of a deep *blue* colour, *Sulphate of Copper*, *Blue* or *Roman Vitriol* (*Cuprum Vitriolatum* P. L.)

Dissolves in diluted *Nitric Acid* with effervescence and the production of *Nitrous Gas*, forming a deep *blue* solution, and by evaporation a deliquescent salt, which detonates on being suddenly heated (*Nitrate of Copper.*) The precipitate obtained from this solution by
adding

adding *Chalk*, forms a beautiful but fugitive pigment, *Blue-verditer*.

Is in its metallic state slowly acted on by the *Muriatic Acid*, unless assisted by heat: the solution, of a *grass green* colour, on evaporation yields *cubical* crystals, whilst a solution of the orange coloured oxyd before mentioned, yields colourless *octobedrons*, which are not affected by *Ammonia*, unless after exposure to air.

Moistened with the *Acetous Acid*, under exposure to air, corrodes into a *green saline oxyd*, *Verdegris of Commerce* (*Ærugo P. L.*), which by additional acid dissolves, and yields a beautiful *dark green* transparent salt, *Distilled Vergedris*: both employed as pigments.

Easily attacked by the *Sebacic Acid* of rancid oil or fat, especially if before in any degree *oxydated*.

Most of the saline preparations of *Copper*, particularly the *Nitrate* and *Muriate*, soluble in *Alcohol*, which then burns with a *green* flame.

Is more or less acted on by all the *Alkalies*. With *Ammonia* forms a beautiful *blue* solution, which disappears on the exclusion and returns on the admission of *Air*. *Ammonia* the most delicate test of the presence of *Copper*, with the exception mentioned above.

Is precipitated of a fine *grass green* colour from its solution in *Sulphuric Acid*, by *Arsenate of Potash*, *Scheele's Green Pigment*.—Of a *blue* colour from the *Nitric Acid* by *Chalk*, as before mentioned, and in a *metallic* state from all its solutions by *Zinc* and *Iron*, *Zement Copper*.

Detonates with melted *Nitre*, and by the assistance of heat decomposes *Muriate of Ammonia*.

Unites by fusion with many of the other *Metals*, forming very important compounds, as with *Platina* into one of great density and hardness; with *Gold*, *Standard Gold*; with *Silver*, *Standard Silver* and *Silver Solder*; with *Tin*, *Bronze* and *Bell-metal*; with *Arsenic*, *Tombac*; with *Zinc*, *Brass* and *Manheim Gold*, and with *Antimony* a violet coloured alloy.

Combines also with *Sulphur* and *Phosphorus* by fusion. Is tarnished by immersion in *hepatized Water*.

The *Oxyds* of *Copper* impart a *greenish* tinge to *Glass*.

Order of attraction in the moist way, *Oxalic*, *Tartareous*, *Muriatic*, *Sulphuric*, *Saccho-lactic*, *Nitric*, *Sebacic*, *Arsenic*, *Phosphoric*, *Succinic*, *Fluoric*, *Citric*, *Formic*, *Lactic*, *Acetous*, *Boracic*,
Prussic

Prussic and Carbonic Acids, Potash, Soda, Ammonia, Unctuous Oils ; in the dry way, Gold, Silver, Arsenic, Iron, Manganese, Zinc, Antimony, Platina, Tin, Lead, Nickel, Bismuth, Cobalt, Quick-silver, Alkaline Sulphurets, Sulphur, Phosphorus.

Use very extensive, being employed in the construction of *Buildings* and *Coppering of Ships*; in the formation of various *Culinary* or other *Utenfils*, in *Bell and Cannon Founding*, in *Coinage*, in *Enamelling*, *Dying*, *Painting* and *Medicine*.

Of Iron.

Of all metals the most frequently and abundantly met with, and generally in the following forms ; 1st. *Native* ; 2d. in state of grey oxyd, *Grey Iron Ore* ; 3d. united with carbonic acid, *Hæmatite* ; 4th. with carbonic acid, alumine, and often phosphoric acid, *Argillaceous Iron Ore* ; 5th. with carbonate of lime and oxyd of manganese, *Spathose Iron Ore* ; 6th. with sulphuric acid, *Native Sulphate of Iron* ; 7th. with chromic

chromic acid, alumine and filex, *Native Chromate of Iron*; 8th. with sulphur, with arsenic, or with both, *Iron Pyrites, Mispickel, Arsenical Pyrites.*

As obtained from its ores by the usual process of reduction, forms a fusible mass, of a bluish grey colour and coarse granular fracture, *Crude or Cast Iron*, which freed from its impurities by continued exposure to a strong heat and subsequent hammering and rolling, loses its brittleness, becomes of a lamellar or fibrous texture, and capable, when red hot, of having several portions welded by compression into a continuous mass, *Bar or Forged Iron.*

This, by cementation or fusion with *charcoal*, acquires weight, becomes again fusible, brittle when cold, of a close granular texture, susceptible of a high polish, very elastic and capable of taking on a great degree of hardness if heated and suddenly cooled, *Common and Cast Steel.*

Of the difference of these three states and manner of distinguishing them.

Bar Iron the purest. Colour of this *bluish grey*, when polished very *splendid*—has a slightly subacid taste, and when rubbed, a sensible *odour*—*harder* than most other metals—more *tenacious* than

than any—considerably more *ductile* than *malleable* ; Sp. Gr. from 7.600 to 8.166.

Iron the only metal obedient to the *Magnet*.

Susceptible of different degrees of *Oxydation*. Is speedily converted into a yellowish or reddish brown rust on exposure to air and moisture, (*Rubigo Ferri P. L.*), and still more speedily into a dark grey oxyd, by combustion in *Oxygen Gas*, digestion in warm *Water*, or the application of its vapour to it under ignition.

Dissolves more or less readily in all the *Acids*. Its solution generally accompanied with the evolution of *Hydrogen Gas*, and the resulting compounds possessing different properties according to its degree of *Oxydation*.

Requires the aid of heat to decompose *Concentrated Sulphuric Acid*, but dissolves readily in it when *diluted*, and yields a pale green crystallizable salt, *Sulphate of Iron, Martial Vitriol* (*Ferrum vitriolatum P. L.*). A less pure salt obtained by the decomposition of *Iron Pyrites, Copperas of Commerce*.

Rapidly decomposes the *Nitric Acid*, by which, unless in a diluted state, it is rather *oxydated* than *dissolved*.

Dissolves readily in the *Muriatic Acid*, and produces

produces a yellowish brown solution, miscible with spirits of wine (*Tinctura Ferri Muriani* P. L.).

Soluble by digestion in the *Acetous Acid*, hence the chalybeate properties communicated by it to the different kinds of wine, (*Vinum Ferri*, P. L.)

Unites also easily with Acid of Tartar (*Ferum Tartarizatum* P. L.)

With *Prussic Acid* forms *Prussian Blue*. Prussiate of Potash or of Lime therefore employed as tests for ascertaining its presence.

In combination with *Carbonic Acid* becomes soluble in water; hence the properties of *Chalybeate Springs*.

With *Gallic Acid* produces a black precipitate, the basis of common *Ink*.

Precipitates spontaneously in the form of ochre from most of its acid solutions on exposure to *Air*. When thrown down from these by an *Alkali*, may be re-dissolved by the addition of a further portion of it, *Alkaline martial Tincture of Stahl*.

Combines with the *Fixed Alkalies* by fusion.

Deflagrates with *Nitrate of Potash*; and sublimes
limes

limes with *Muriate of Ammonia*, which it partially decomposes (*Ferrum Ammoniacale* P. L.)

When in the state of *Oxyd*, promotes the fusion of several of the *Earths*, and communicates different tinges to *Glass*, according to the degree of *Oxydation*.

Unites by fusion with all the other metals, except *Quick-silver*, *Lead*, and *Bismuth*. In combination with *Arsenic*, becomes brittle when heated, (*Red-short Iron*.)

Has of all metals the strongest attraction for *Sulphur*, with which, when heated, it unites very readily into a dark grey, brittle, and remarkably hard compound, *Artificial Pyrites*.

Is also capable of entering into combination with phosphorus, (*Cold-short Iron*), and with charcoal, *Steel* and *Plumbago*.

Order of attraction in the moist way, *Oxalic Acid*, *Tartareous*, *Sulphuric*, *Saccho-lactic*, *Muriatic*, *Nitric*, *Sebacic*, *Phosphoric*, *Arsenic*, *Fluoric*, *Succinic*, *Citric*, *Formic*, *Lactic*, *Acetous*, *Boracic*, *Prussic*, and *Carbonic*; in the dry way, *Nickel*, *Cobalt*, *Manganese*, *Arsenic*, *Copper*, *Gold*, *Silver*, *Tin*, *Antimony*, *Platina*, *Bismuth*, *Lead*, *Quick-silver*, *Alkaline Sulphurets*, *Sulphur*, *Phosphorus*.

Uses too extensive to be enumerated.

Of

Of Tin.

Found either united with Oxygen and Iron—*Spathose Tin Ore*; or with Sulphur, Copper and Iron—*Tin Pyrites*.

Colour *silvery white*; *splendid*; the *lightest* of all the ductile metals, (its Sp. Gr. when pure being only from 7.291 to 7.500,) and next to Lead, the *softest*; *inelastic*; comparatively of little *Tenacity* or *Ductility*, but considerably *malleable*; has a strong disagreeable *Taste*, and emits a peculiar *Odour* when rubbed.

Tarnishes under exposure to air; but does not speedily *oxydate* even by the combined action of air and moisture; hence its use as a covering to Iron and Copper.

Melts long before ignition (410 *Farenh.*) and kept in fusion with access of *Air* is easily converted into a *grey oxyd* (*Putty*); by a continuance of the heat is changed into a perfectly *white Oxyd*, extremely difficult of fusion or reduction, *Basis of White Enamel*: a similar *Oxyd* obtained by exposing it when in fusion to the vapour of *Water*.

Broken

Broken when nearly or just congealed, exhibits an irregular columnar *Structure*, and by agitation while passing from the fluid to the solid state, may be reduced into very small grains (*Pulvis Stanni P. L.*)

Does not dissolve in the *Sulphuric Acid*, but by the assistance of heat decomposes it and becomes *oxydated*.

Rapidly decomposes the *Nitric Acid*, with a copious evolution of *Nitrous Gas*, and is converted into a *white Oxyd*: but in the considerably diluted acid, unaided by heat, dissolves and forms *Nitrate of Tin*, which burns with a thick white flame, and detonates in a heated crucible.

Dissolves readily in the *Muriatic Acid*; the solution yielding needle-form crystals which attract moisture.

Dissolves with still greater readiness in the *Oxy-muriatic Acid*, and in the *Nitro-muriatic Acid*, or *Aqua Regia*, yielding solutions remarkable for their property of forming a brilliant and permanent scarlet precipitate with infusion of *Cochineal* and other analagous substances, (*Carmine*, and *Scarlet-dye*.) When united with *Oxy-muriatic Acid* in the *dry way*, by distillation with *Muriate of Quicksilver*, a volatile colourless

liquor is obtained, which, on exposure to the air, emits copious dense white fumes, *Smoking Liquor of Libavius*.

Is slowly corroded by the continued application of the *Acetous Acid* in the form of vapour; and by long digestion, this acid dissolves a small proportion of it.

The solutions of *Caustic Fixed Alkalies*, assisted by heat, exert a solvent power both on *Tin* and its *Oxyds*, but most on the latter: *Caustic Ammonia* affects only the *Oxyds*.

Is little affected in the *dry way*, either by *Alkalies* or *Earths*, but decomposes the compounds of the former with the *Sulphuric Acid*. Detonates rapidly with *Nitre*, and decomposes *Muriate of Ammonia*.

Decomposes moistened *Nitrate of Copper* with an impetuosity productive of actual combustion.

May be united more or less readily with all the other *Metals*, and in various proportions; occasioning in most of them an alteration in their *Malleability*, *Fusibility*, *Specific Gravity* and *Hardness*: with *Copper*, according to the proportions, forms *Gun-Metal*, *Bronze*, *Bell-Metal*, *Speculum-Metal*; with a small proportion of *Iron* becomes harder and more sonorous; with
half

half its weight of *Bismuth* forms *Tutenag*; with an equal weight of *Lead*, *Soft Solder*. When free from *Arsenic* does not, in small quantity, much impair the malleability of *Gold*.

Melted with *Sulphur*, produces a dark grey, striated, brittle compound; which, if prepared by sublimation, is of a light spongy texture and composed of golden coloured scales, used to imitate bronze, *Sulphurated Oxyd of Tin*, *Aurum Musivum*; which may also be prepared by heating gradually equal parts of *Sulphur* and the *White Oxyd*.

May also be combined with *Phosphorus*.

Order of Attraction in the moist way, *Sebacic*, *Tartareous*, *Muriatic*, *Sulphuric*, *Oxalic*, *Arsenic*, *Phosphoric*, *Nitric*, *Succinic*, *Fluoric*, *Saccho-lactic*, *Citric*, *Formic*, *Lactic*, *Acetic*, *Boracic*, *Prussic*, *Potash*, *Ammonia*; in the dry way, *Zinc*, *Quicksilver*, *Copper*, *Antimony*, *Gold*, *Silver*, *Lead*, *Iron*, *Manganese*, *Nickel*, *Arsenic*, *Platina*, *Bismuth*, *Cobalt*, *Alkaline Sulphurets*, *Sulphur*, *Phosphorus*.

Employed in the composition of *Solder*, *Pewter*, *Bell and Gun-Metal*, *Printer's Types*, &c. in the silvering of *Mirrors*, construction of
Electrical

Electrical Instruments ; in Tinning, Enamelling, Dying, Medicine, &c.

Of Bismuth.

Found 1st. *Native* ; 2d. in union with Oxygen, *Native Oxyd* ; 3d. with Sulphur, *Sulphuret of Bismuth*.

Manner of procuring it from its Ores.

Colour, *yellowish white*.—Specific gravity 9.822.—Texture *foliated*—not very brittle.

But little subject to tarnish. Melts at 460 *Farenh.* and in cooling crystallizes into cubes.

If kept in fusion with access of *Air* is converted at first into a bluish and afterwards into a brown *Oxyd*.—Heated to redness burns, with a small blue flame, and emits a yellowish smoke, condensable into an *Oxyd* of a similar colour, (*Flowers of Bismuth*), which by increase of heat melts into a greenish *Glass*, analogous to glass of *Lead*.

Dissolves most readily in the *Nitric Acid*, and furnishes a salt, which detonates readily when exposed to sudden *Heat* ; and which may be decomposed

decomposed by the affusion of *Water*, yielding a white *Oxyd*, (*Magistery of Bismuth*). The other acids dissolve its oxyds, but do not act upon the metal.

Its precipitate by *Sulphuret of Ammonia* of a similar appearance to that which this produces in solutions of *Lead*.

Deflagrates both with *Nitre* and with *Oxymuriate of Potash*, and is converted into an *Oxyd*, which, like those already mentioned, facilitates the fusion of the *Earthy Bodies*, and also of the other *Metallic Oxyds*.

Combines with most of the other *metallic Substances*, rendering *Platina*, *Gold*, and *Silver* more brittle, and the metals in general more fusible.

Precipitates *Platina*, *Gold*, *Silver*, and *Quick-silver* from their acid solutions, but is itself precipitated by *Lead*.

Has very little affinity to *Phosphorus*.

Unites easily with *Sulphur* into a bluish-grey striated compound, which resembles the native *Sulphuret*, and may be decomposed by *Silver* and *Lead*.

Its *Oxyds*, like those of *Lead*, dissolve in *Unctuous Oils* by the assistance of heat.

Order

Order of Attraction in the moist way, *Oxalic Acid, Arsenic, Tartareous, Phosphoric, Sulphuric, Sebacic, Muriatic, Nitric, Fluoric, Saccho-lactic, Succinic, Citric Formic, Lactic, Acetous, Prussic, Carbonic, Ammonia*; in the dry way, *Lead, Silver, Gold, Quicksilver, Antimony, Tin, Copper, Platina, Nickel, Iron, Zinc, Alkaline Sulphurets, Sulphur.*

Used in the composition of *Pewter, Solder, and Printer's Types*, in *Painting, Imitation of Silvering*, and occasionally in place of *Lead* in the refinement of *Gold and Silver*, and in *Assaying*.

Of Nickel.

Found 1st. alloyed with Iron, *Native Nickel*; 2d. combined with Oxygen, *Native Oxyd*; 3d. with Iron, Arsenic, Cobalt and Copper, *Kupfer Nickel*.

Extremely difficult to obtain it free from iron: accordingly varies somewhat in colour, being occasionally *reddish, yellowish or greyish white*.—Specific gravity also varies from 7.88
to

to 9.333.—Texture *minutely granulated*.—Hard yet somewhat *malleable*. Is likewise (perhaps from the admixture of iron) *magnetic*.

Requires nearly the same heat as iron to fuse it; is very fixed in the fire, and difficult of oxydation by heat.

Deflagrated with *Nitre* yields a *greenish Oxyd*, which communicates a hyacinthine tinge to *Glass*.

All its solutions of a *green* colour: that in the *Nitric Acid* (in which it dissolves most readily) affords green rhombic crystals.—Precipitated from its solutions by lime water, and by the alkalies; *Ammonia* re-dissolves it, and produces a *blue* solution.

Forms brittle compounds with *Gold*, *Copper*, *Iron* and *Tin*; refuses to combine either with *Silver* or *Quicksilver*, and unites readily by fusion both with *Sulphur* and *Phosphorus*.

Order of Attraction in the moist way, *Oxalic*, *Muriatic*, *Sulphuric*, *Tartareous*, *Nitric*, *Sebacic*, *Phosphoric*, *Fluoric*, *Saccho-lactic*, *Succinic*, *Citric*, *Formic*, *Lactic*, *Acetous*, *Arsenic*, *Boracic*, *Prussic* and *Carbonic Acids*, *Ammonia*; in the dry way, *Iron*, *Cobalt*, *Arsenic*, *Copper*, *Gold*, *Tin*,
Antimony,

Antimony, Platina, Bismuth, Lead, Silver, Zinc, Alkaline Sulphurets, Sulphur, Phosphorus.

This Metal not yet applied to any use.

Of Arsenic.

Found 1st. alloyed by Iron, *Native Arsenic*; 2d. combined with Oxygen, *Native Oxyd*; 3d. with different proportions of Sulphur, *Realgar, Orpiment*; and 4th. with Sulphur, Iron and sometimes Silver, *Misspickel*.

Colour, *steel-grey*—texture, *scaly*—very brittle, but not hard.—Specific gravity 5.763 to 8.31.—Much disposed to *tarnish*.

Volatile in close vessels at 356 of *Farenh.* and in condensing crystallizes in tetrahedrons.

If exposed to *Air* under the heat of ignition, burns with a blue flame, and is converted into a white Oxyd, *Common white Arsenic, Flowers of Arsenic, Arsenious Acid*.

This soluble in about 80 times its weight of cold and 15 times its weight of boiling water.—Taste, *caustic*.—Less volatile than the *Regulus*.—Emits a garlic smell on the application of Heat.

Heat.—*Vitreſcible.*—Promotes the fuſion of *Earthy Bodies*. When melted with *Sulphur*, produces different ſhades of colour, according to the proportions and the degree of *Heat* or ſtate of *oxydation*; hence artificial *Orpiment* and *Realgar*.—By treatment with the *Nitric Acid*, becomes more completely *oxygenated*, *Arsenic Acid*.—Decompoſes *Nitre* in the dry way, producing a neutral cryſtallifiable ſalt, *Arsenical Salt of Macquer*.—If diſtilled with unctuous matter, reſumes the form of *Regulus*.

In its *metallic* ſtate, decompoſes moſt of the mineral acids; the *nitric* moſt readily: if powdered and thrown into *Oxy-muriatic Acid Gas*, burns with a *white flame*.

Unites with moſt of the other *Metals*; rendering brittle thoſe which are ductile, and in a remarkable manner increaſing the fuſibility of ſome, and diminiſhing that of others: thrown into *Oxy-muriatic Acid Gas*, burns with a *blue flame*.

To the red and yellowiſh metals communicates a ſilvery whiteness.

Soluble in *Alkaline Sulphurets*. Soluble alſo in *Unctuous Oils*, with which it forms a conſiſtent mixture.

Combines

Combines readily with *Phosphorus*.

Most of the preparations of this metal in a high degree *noxious*; the detection of their presence therefore often of great moment: the best antidote, *Hepatic Waters* and *Alkaline Sulphurets*.

Order of attraction in the moist way, *Muriatic Acid*, *Oxalic*, *Sulphuric*, *Nitric*, *Sebacic*, *Tartareous*, *Phosphoric*, *Fluoric*, *Saccho-lactic*, *Succinic*, *Citric*, *Formic*, *Lactic*, *Arsenic*, *Acetous* and *Prussic*, *Ammonia*, *Unctuous Oils*, *Water*: in the dry way, *Nickel*, *Cobalt*, *Copper*, *Iron*, *Silver*, *Tin*, *Lead*, *Gold*, *Platina*, *Zinc*, *Antimony*, *Alkaline Sulphurets*, *Sulphur*, *Phosphorus*.

Used principally in *Glass-making*, *Painting*, and *Medicine*.

Of Cobalt.

Found 1st. alloyed with Arsenic, *Grey Cobalt Ore*; 2d. united to Oxygen, *Native Oxyd*; 3d. to Arsenic Acid, *Cobalt Bloom*; 4th. to Sulphur, *Sulphuret of Cobalt*; and 5th. to Arsenic, Iron, and Sulphur, *White Cobalt Ore*.

Colour,

Colour, *light grey*. Specific gravity, from 7.7 to 8.53.—*Compact, brittle; hardness* that of *Tin*.

When very pure, malleable in a red heat.—Fuses at 130 *Wedgw.* and in cooling crystallizes in irregular prisms.—Undergoes no change either on exposure to *Air* or *Water* at a common temperature; but, when heated in contact with air, yields at first a brownish oxyd, *Zaffre*, which on further exposure becomes blue, and on fusion with *Silex*, produces a blue glass, *Smalt, Powder-blue*.

Dissolves with more or less facility in several acids; most easily in the *Nitric Acid*.

With the *Muriatic* and *Oxy-muriatic Acids* forms compounds, the reddish solutions of which, as often as exposed to heat, change to a beautiful green, *Sympathetic Ink*.

Detonates feebly with *Nitre*.

Unites by fusion with most of the other *Metals*.

Combines difficultly if at all with *Sulphur*; more readily with *Alkaline Sulphurets*.

With *Phosphorus* forms a compound more fusible than itself.

Its *Oxyd* soluble in *Ammonia*.

Order

Order of Attraction in the moist way, *Oxalic Acid, Muriatic, Sulphuric, Tartareous, Nitric, Sebacic, Phosphoric, Fluoric, Saccho-lactic, Succinic, Citric, Formic, Lactic, Acetous, Arsenic, Boracic, Prussic, Carbonic, Ammonia*; in the dry way, *Iron, Nickel, Arsenic, Copper, Gold, Platina, Tin, Antimony, Zinc, Alkaline Sulphurets, Sulphur? Phosphorus.*

Used to colour *Glass*, in *Glazing, Enamelling, Painting, Washing, &c.*

Of Zinc.

Found 1st. combined with Oxygen, and frequently mixed with Oxyd of Iron, Silex and Alumine, *Calamine*; 2d. with Sulphur, Oxygen and other substances, *Sulphuret of Zinc* or *Blend*; 3d. with Sulphuric Acid, *Sulphate of Zinc*; 4th. with Carbonic Acid, &c. *Carbonate of Zinc?*

Colour *bluish-white*. Specific gravity 7,190.

Somewhat *malleable*, and more so when *cold* than *hot*. Texture *laminated*.

When heated is easily pulverised; and like iron is capable of decomposing *Water*. Melts at about 700 of *Farenh.* Very easily volatilized.

In

In contact with air, burns soon after ignition, with a brilliant flame, and furnishes a white flocculent *Oxyd* (*Flores Zinci* P. L.), convertible by an increase of heat into a yellowish *Glass*.

Is readily acted on by Acids. During its solution in the *Sulphuric* and *Muriatic Acids*, *Hydrogen Gas* is evolved. Produces with the former Acid, a styptic crystallisable salt, (*Zincum Vitriolatum* P. L.); is also acted on by *Alkaline* solutions, and by *Water* previously impregnated with *Carbonic Acid Gas*.

May be precipitated from its solutions by *Earths* and *Alkalies*.

Decomposes, in the dry way, *Sulphate of Potash* and many other compounded salts. Detonates violently with *Nitre*. By simple trituration decomposes *Muriate of Ammonia*. Is also capable of precipitating *Alum*, in the moist way.

Unites with all the other metallic substances except *Bismuth*; giving to *Copper* additional elasticity, durability, and hardness.

In its *metallic form* cannot be combined with *Sulphur*; but when *oxydated* unites readily with it.

Order of attraction in the moist way, *Oxalic Acid*, *Sulphuric*, *Muriatic*, *Saccho-lactic*, *Nitric*,
Sebacic,

Sebacic, Tartareous, Phosphoric, Citric, Succinic, Fluoric, Arsenic, Formic, Lactic, Acetous, Boracic, Prussic and Carbonic, Ammonia; in the dry way, *Copper, Antimony, Tin, Quicksilver, Silver, Gold, Cobalt, Arsenic, Platina, Bismuth, Lead, Nickel, Iron.*

Uses—in *Alloys*, particularly with *Copper* and *Tin*; externally and internally in *Medicine*.—~~It is~~
A powerful agent in evolving *Galvanism*.

Of Antimony.

Found 1st. *Native*; 2d. alloyed with *Arsenic*, *Native Arsenical Antimony*; 3d. in union with *Oxygen*, *Native Oxyd*; 4th. with *Muriatic Acid*, *Muriate of Antimony*; 5th. with *Arsenic Acid* and *Sulphur*, *Red Antimonial Ore*; 6th. with *Sulphur* only, *Grey Antimonial Ore*; and 7th. with *Iron*, *Arsenic*, *Sulphur*, and sometimes *Silver*, *Plumose Antimonial Ore*.

Manner of extracting it from its ores, and the different processes for obtaining its *Regulus*.

Colour, *silvery-white*. Hardness, equal to
Zinc.

Zinc. Texture, *laminated*. Very brittle. Sp. Gr. from 6.702 to 6.860. Simply loses its lustre on exposure to the *Air*; and is not altered by *Water* unless exposed to it when red hot.

Melts soon after ignition; on cooling *crystallizes* into octohedrons; is *volatile* in close vessels. When heated in contact with *Air* is converted into a light *white Oxyd*, (*Argentine Flowers of Antimony*,) which are soluble in water, and fusible into an *Hyacinthine Glass*; in close vessels by parting with different portions of oxygen, they acquire a *brown, orange, or yellow* colour.

Decomposes both the *Sulphuric* and *Nitric Acids*, the former with, the latter without, the assistance of heat. Requires long digestion for its solution in the *Muriatic Acid*; but in the *Oxy-muriatic* dissolves with great facility.

Precipitable from the latter by Zinc or Iron in the form of a *black Oxyd*, which when dried by a gentle heat *takes fire* spontaneously in the air, and is converted into *white Oxyd*.

Decomposes, in the dry way, most of the saline *Compounds* of the *Sulphuric Acid*. Detonates readily with *Nitre*; and decomposes *Muriate of Quicksilver*.

Combines with most other *Metals*, and renders them *brittle*. Said more than any other metal to diminish the *Magnetic* property of *Iron*.

Unites with *Sulphur* in all proportions, and forms with it a *grey striated* compound, *Antimony* of the shops.

This when exposed for a continuance to a low heat, yields a *grey Oxyd*, which by fusion is converted into a *yellowish Glass* (*Vitrum Antimonii* P. E.); this levigated and mixed with melted wax forms the *Vitrum Antimonii Ceratum*.

Roasted with *Hartshorn* and afterwards ignited, yields a *white Powder*, (*Pulvis Antimonialis* P. L. *Antimonium Calcareo-Phosphoratum* P. E.)—When deflagrated with *Nitre*, is more or less decomposed according to the degree of combustion (*Antimonium Calcinatum* P. L. *Antimonium Ustum cum Nitro* P. E. *Crocus Antimonii* P. L. and P. E.)

Nature of these preparations.

Reduced to powder and boiled in a solution of *Potash*, deposits, on cooling, an *orange coloured* precipitate (*Kermes Mineralis* Ph. Suec.); on the addition of the *Sulphuric Acid* to the solution whilst hot, a *brownish red* precipitate,
(*Sulphur*

(*Sulphur Antimonii præcipitatum* P. L. and P. E.)

These *Hydro-sulphurated Oxyds of Antimony*.

A mixture of *Sulphuret of Antimony* and *Muriate of Quicksilver* or of *Crocus of Antimony* and *common Salt*, with the addition of *Sulphuric Acid*, produces, by distillation, a butyraceous compound (*Antimonium Muriatum* P. L. and P. E.), which on the affusion of common water, or by the addition of Potash, furnishes a *white Oxyd, Powder of Algaroth*. The combination of this with acidulous Tartrate of Potash, forms a triple salt (*Antimonium Tartarifatum* P. E.)

A similar preparation obtained from *Glass* or *Crocus of Antimony* (*Antimonium Tartarifatum* P. L.), which are also soluble in different kinds of Wine (*Vinum Antimonii* P. L.)

Order of attraction in the moist way, *Sebacic Acid, Muriatic, Oxalic, Sulphuric, Nitric, Tartareous, Saccho-lactic, Phosphoric, Citric, Succinic, Fluoric, Arsenic, Formic, Lactic, Acetous, Boracic, Prussic* and *Carbonic*; in the dry way, *Iron, Copper, Tin, Lead, Nickel, Silver, Bismuth, Zinc, Gold, Platina, Quicksilver, Arsenic, Cobalt, Alkaline Sulphurets, Sulphur*.

Used in the composition of *Printer's Types*, and of *Nails for Coppering Ships*, in *Medicine*, &c.

Of Manganese.

Found 1st. *Native* ; 2d. in union with Oxygen, *Native Oxyd* ; and 3d. with Oxygen, Silex, Iron, and Alumine, *Siliceous Manganese*.—Said also to be contained in the ashes of most *Vegetables*.

Colour *dull* or *greyish white*. Texture, *granular*. Sp. Gr. from 6.850 to 7. Hardness next to *Iron*. *Very brittle*.

Next to *Platina* difficult to fuse ; but *oxydates* more easily than any other metal : its *Oxyd* of different colours, *white*, *red* and *black*.

Soluble in the diluted *Sulphuric*, in the *Nitric*, *Muriatic* and several other acids.

In the state of *Oxyd*, occasions in the *Muriatic Acid* a striking change of properties, by imparting to it a portion of its *Oxygen*.

Its action on the *Alkalies* not yet ascertained.

When oxydated, decomposes both *Nitrate of Potash* and *Muriate of Ammonia*, in the dry way.

In this state unites by fusion with the *Earthy Bodies*, and when added to *Glass*, either renders it *colourless* or communicates a *violet* tinge, according to the degree of *Oxydation*.

Unites

Unites also, by fusion, with *Sulphur*, into a *yellowish-green* mass. By mixture with unctuous substances sometimes occasions *Inflammation*.

Combines in the metallic state with most of the other *Metals*, rendering *Gold* and *Iron* more fusible, *Copper* less.

Order of attraction in the moist way, *Oxalic Acid*, *Citric*, *Phosphoric*, *Tartareous*, *Fluoric*, *Muriatic*, *Sulphuric*, *Nitric*, *Saccho-lactic*, *Succinic*, *Sebacic*, *Arsenic*, *Formic*, *Lactic*, *Acetous*, *Prussic* and *Carbonic*; in the dry way, *Copper*, *Iron*, *Gold*, *Silver*, *Tin*, *Alkaline Sulphurets*.

Employed principally in *Glass-making* and *Bleaching*.

Of Tungsten or Wolfram.

Found, 1st, in an *acid* form in combination with *Lime*, *Tungstate of Lime*; and 2d. with *Oxyd of Manganese* and of *Iron*, *Silex*, and *Tin*, *Wolfram*.

Colour *steel grey*. Texture *granular*. *Extremely hard*. Sp. Gr. 17.6.

Nearly *infusible*, requiring a heat at least equal to 170° *Wedg*.

Yields

Yields a yellow *Oxyd*, (*Acid of Tungsten*,) which in close vessels becomes *blue* or *black*.

Insoluble in the *Sulphuric*, *Nitric*, and *Muriatic Acids*. Slightly soluble in the *Oxy-Muriatic*.

Combines with the other *Metals*. Does not lessen the ductility of *Silver* or *Copper*; but renders *Iron*, *Tin*, *Bismuth*, *Antimony*, and *Manganese* harder.

Order of Attraction in the moist way, *Lime*, *Potash*, *Ammonia*; in the dry way, *Potash*, *Lime*, *Iron*, *Manganese*.

Not as yet applied to any use.

Of Uranium.

Found, 1st, in combination with Sulphur, *Pechblende*; 2d. with Oxygen, (on the surface of the former) *Yellow Oxyd*; and 3d. with Carbonic Acid and a little Copper, *Calcolite*.

Has been but imperfectly reduced.

Appears capable of uniting with several of the *Acids*.

Its *Oxyds* tinge glass of various colours, *brown*, *grey*, and *green*.

Of

Of Molybdena.

Found in combination with Sulphur, *Molybdena*, formerly confounded with *Plumbago*.

Hitherto obtained only in *agglutinated grains*.

Colour, externally *whitish yellow*, internally *grey*. Sp. Gr. 7.5. *Brittle*.

Less fusible than either *Platina* or *Manganese*.

According to the experiments of Mr. Hatchett, is capable of combining with four different portions of *Oxygen*, producing a *black*, a *blue*, a *green Oxyd*, (*Molybdous Acid*), and a *yellow or white* (*Molybdic Acid*.)

When combined with *Iron*, *Copper* and *Silver*, renders them friable.

In union with *Sulphur* regenerates *Sulphuret of Molybdena*.

Order of Attraction unknown.

Not yet applied to any use.

Of Titanium.

Found combined with *Oxygen* in the *Red Schorl* of Hungary; and in *Manachanite*.

Of

Of a colour somewhat resembling *Copper*. Appears to be *infusible*, but capable of being *volatilized*.

Difficultly *oxydated* by any of the acids.

With *Iron* forms a compound of a gold colour internally.

Of Tellurium.

Found in several of the *Ores of Gold*; and in considerable proportion.

Of a *whitish-lead* colour; *metallic lustre*; *laminated texture*; *very brittle*; Sp. Gr. 6.115.

Of all metallic substances the *most fusible* except *Quicksilver*, like which it may be *sublimed* in brilliant globules.

Burns with a *bluish-green* flame. Soluble in the *Nitric*, *Muriatic*, and *Sulphuric Acids*; from which it may be precipitated by *Alkaline Sulphurets* in the form of a powder, in appearance much resembling *Kermes Mineral*.

Said to be the only metal, except *Gold*, *Platina* and *Antimony*, which is not precipitated from its solutions by *Prussian Alkali*.

Its

Its *Oxyds* so rapidly reduced on heated *Charcoal* as to occasion actual *detonation*.

Of *Chrome*.

Found 1st, in an *Acid* form combined with *Oxyd* of Lead, *Red Lead* of *Siberia*; and in a similar acid form in the *pale red Ruby*; 2d. with *Oxygen*, in the *green Emerald* of *Peru*.

May be obtained in a *concrete acid* state, and of a red colour, from the two first, by treatment with *Carbonate* of *Potash*; or in the form of a *green Oxyd* from the last by treatment with *Muriatic Acid*.

Has as yet been but imperfectly reduced.

Of a *greyish white* colour; *very hard*; *very brittle*; and *very difficult* of *fusion*.

Not soluble in the *Muriatic* or *Sulphuric Acids*; and difficultly in the *Nitric* and *Oxy-muriatic*.

Combined, in its *Acid* state, with *Muriatic Acid*, is capable of dissolving *Gold*.

Of

Of Columbium.

Lately discovered in an *Acid state* by *Mr. Hatchett*, in a dark grey mineral, sent with some iron ore from *America*, and which appears to consist of more than three-fourths of this acid combined with iron. Its colour in this state is *white*; it *reddens* litmus paper; is insoluble in boiling *Nitric Acid*, but soluble in *Sulphuric Acid* when strongly heated, and also, when recently separated from Potash, in boiling *Muriatic Acid*.

It gives colourless solutions with *Acids* and *Alkalies*; is precipitated from its acid solutions by Alkalies in *white flocculi*, by Prussiate of Potash of an *olive green colour*, and by Tincture of Galls of a *deep orange*.

Is extremely difficult of reduction.

OF COMBUSTIBLE SUBSTANCES.

The substances usually denominated *Combustible*, are such as are more especially remarkable for exhibiting the phenomenon of *Combustion*, when heated to a certain degree in contact with *Air*.

The changes produced on the *Air* in this process, and the alteration which the *inflammable Substances* themselves undergo, already particularly treated of.

In their *Form*, *Consistence*, *Weight*, *Volatility*, &c. the substances of this class differ widely from each other. They are comparatively *lighter* than most other bodies.

May be divided into two classes—*Simple* and *Compounded*.

The simple combustibles are, *Hydrogen*, *Carbon*, *Sulphur* and *Phosphorus*.

Hydrogen.

Already treated of under *Aeriform fluids*.

Carbon.

Carbon.

Obtained in its common form, *Charcoal*, from vegetable, animal and bituminous substances by exposure to heat in close vessels.

Varies in its form, quantity, and purity, according to the nature of the substance from which it is prepared.

The charcoal of common wood, *black, light, brittle, sonorous, insipid, inodorous*, and of great *durability*.

Capable of sustaining the most intense degrees of *Heat* in close vessels, without alteration; but upon access of *Air*, burns with a white flame, and yields *Carbonic Acid Gas*, leaving behind a small quantity of *earthy saline Ashes*.

Decomposes the *Sulphuric Acid* and all its compounds, by the assistance of *Heat*.

Decomposes also the *Nitric Acid* without *Heat*, and sometimes with such rapidity as to occasion *Combustion*. Detonates with *Nitre*.

Dissolves, by fusion, in the *fixed Alkalies*; very readily also in *Alkaline Sulphurets*.

Combines by cementation with *Iron* either
in

in a small proportion, *Steel*, or in a larger, *Plumbago*.

Of the properties and uses of *Native Plumbago*.

Charcoal remarkable for correcting *Fætor*, and depriving many substances of *Colour*, especially when used in its fresh-burnt state.

Exists in its purest form in the *Diamond*, which for its complete combustion requires more oxygen than charcoal, and produces a larger portion of *Carbonic Acid Gas*.

Used chiefly as an article of *Fuel*, and in certain arts, trades, and manufactures.

Of Sulphur.

Found either uncombined, as deposited by water, or sublimed by subterranean fire, *Native Sulphur*; or in combination with other bodies, more especially with different *Metals*.

May be obtained artificially by the decomposition of *Sulphuric Acid*.

Colour, *pale yellow*.—Sp. Gr. 2.033.—*Hard, brittle, insipid, insoluble*.—Very easily melted.—

Sublimes

Sublimes in close vessels into *light yellow flowers*,
(*Flores Sulphuris* P. L.)

Burns with a *blue* flame, and by absorbing *Oxygen* from the Air, is converted into *Sulphureous Acid Gas*, *Sulphureous* or *Sulphuric Acid*, according to the proportion of this principle.— Similar effects are produced on it by deflagration with *Nitre*.

Is little affected by *Acids*.

Unites readily with the *Alkalies*, and also with the *saline Earths*, producing liver-coloured compounds (*Sulphuret of Potash*, &c.) which are soluble in *Water*, and may be decomposed by all the *Acids* (*Sulphur præcipitatum* P. L.

When intimately mixed with certain proportions of *Potash* and *Nitre*, produces a compound which when gradually exposed to heat explodes with great violence (*Pulvis fulminans*).

With *Nitre* and *Charcoal*, in mixture, it constitutes *common Gunpowder*.

Combines by fusion with all the metals except *Platina*, *Gold*, and *Zinc*.

Is insoluble in *Spirit of Wine*, but unites with *oily* matter of every kind, and with all the liquid *bituminous* bodies, into compounds of increased consistence (*Balsams of Sulphur*).

Order

Order of attraction in the moist way, *Lead, Tin, Silver, Quicksilver, Arsenic, Antimony, Iron, Potash, Ammonia, Baryt, Lime, Magnesia, Unc-
tuous Oils, Essential Oils, Æther, Spirit*; in the
dry way, *Potash, Soda, Iron, Copper, Tin, Lead,
Silver, Cobalt, Nickel, Bismuth, Antimony, Quick-
silver, Arsenic.*

Employed principally in *Bleaching*, in the
manufacture of *Sulphuric Acid*, and of *Gun-
powder*, frequently also in *Medicine*.

Of Phosphorus.

Obtained, by decomposing calcined *Bones* by
means of diluted *Sulphuric Acid*, evaporating
the supernatant liquor to the consistence of a
syrup, mixing it with powdered *Charcoal*, and
distilling in the open fire; or by adding *Nitrate*
or *Acetite* of *Lead* to common *Urine*, collecting
the precipitate, mixing this with *Charcoal* and
distilling as above.

Purified by cautious re-distillation, or strain-
ing it, when melted, through leather.

Colour *pearly-white*. *Semitransparent*. *Waxy*.
Insoluble in Water. *Very fusible*.

When

When exposed to air, at a low temperature, emits a white fume, and is luminous in the dark; if heated, burns with great rapidity; and in both cases acquires acid properties, *Phosphoric Acid*.

Decomposes the *Nitric Acid*, occasioning combustion by the sudden separation of its *Oxygen*.

By treatment with the *fixed Alkalies* or *Lime*, yields a permanently elastic fluid, which explodes on admission of *Air* (*Phosphoric Gas*.)

Dissolves in *Essential* and *Unctuous Oils*, *Spirit of Wine*, and *Æthers*.

Unites by fusion with *Sulphur*.

Unites also with several of the *Metals*, and decomposes most of their *Oxyds*.

Used in the preparation of *liquid Phosphorus*, *Phosphoric Matches*, and portable *Phosphoric Bottles*. Attempts have also been made to employ it medicinally in small doses.

Compound Combustibles.

Found abundantly in the vegetable, animal, and mineral departments; some prepared artificially.

Consist

Consist principally of *Hydrogen* and *Carbon* variously combined.

May be divided into five kinds, *Alcohol* and *Æther*, *Fixed Oils*, *Volatile* or *Essential Oils* and *Resins*, *Bitumen*.

Of *Alcohol*.

Obtained from such organised substances, or their products, as have undergone the *Vinous Fermentation*, of which those containing *saccharine Matter* are alone susceptible.

This process materially influenced by *Rest*, *Dilution*, *Temperature*, and *Exposure to Air*. —Divisible into different stages, the *vinous* productive of *Alcohol*, the *acetous* affording *Vinegar*, and the *putrid* generating *Ammonia*.

These changes promoted or retarded by various means, *Ferments*.

Repeated distillation and digestion on dried *Muriate of Lime* or on *Potash*, necessary to bring *Alcohol* to its utmost degree of purity.

When pure *colourless* and *transparent*.

Taste *hot* and *pungent*. Sp. Gr. 0.815.

Miscible with *Water* in all proportions.

Burns with a bluish flame, producing in combustion *Carbonic Acid Gas* and *Water*.

Undergoes singular changes in its properties by treatment with the different *Acids*; hence the preparation of *Æthers*, *Oleum Vini*, &c.

Dissolves the *Alkalies*, and many of the compounded neutral *Salts*, particularly such as are deliquescent. Also dissolves *Soap*, and acts readily as a solvent on *Essential Oils* and *Resins*, on *Balsams* and on *Camphor*; hence the preparation of various *Spirituuous Liquors*, *Tinctures*, *Varnishes*, &c.

Considered by *Mr. Lavoisier* and others, as a compound of *Hydrogen*, *Carbon*, and *Oxygen*, produced by the decomposition of the sugar, in the act of *Fermentation*.

Order of Attraction, *Water*, *Æther*, *Essential Oils*, *Ammonia*, *Potash*, *Alkaline Sulphurets*, *Sulphur*.

In general use for various *technical* as well as *dietetical* and *medical* purposes.

Of Fixed Oils.

Obtained both from *Vegetables* and *Animals*.

From the *former* sometimes by boiling, but mostly by pressure, from certain *Fruits, Kernels,* and *Seeds*, hence called *Expressed Oils*; called also *Unctuous Oils*.

From the adipose membrane of the *latter*, of different colours and consistence according to the part, the age, and the species of animal from which it is taken, *Lard, Suet, Fish Oil*.

The difference between Animal and Vegetable Oils not exactly ascertained. The Animal in distillation furnish a peculiar acid, *Sebacic Acid*.

Both vary in the temperature at which they become *solid*; are insoluble both in *Water* and *Alcohol*; become *rancid* by keeping; yield, by distillation in close vessels, an *acid Phlegm*, a lighter and a denser *Oil*, (*Empyreumatic Oil*), a large quantity of *Hydrogen Gas* mixed with *Carbonic Acid Gas*, and leave behind a small proportion of *Charcoal*.

Afford *Water* and *Carbonic Acid Gas* by inflammation in contact with *Air*.

By mixture with the stronger *Acids*, produce, in some instances, *saponaceous Compounds*; in others occasion *Combustion*.

Unite more perfectly with the *Alkalies*, more especially with *Potash* and *Soda*; with the latter, form common *Soap*.

Unite also into saponaceous compounds with *Baryt*, *Lime*, and *Magnesia*.

Have no action on any of the *Metals* except *Copper* and *Iron*, but assisted by heat dissolve most of the *metallic Oxyds*, and when separated again from these, are found to be soluble in *Alcohol*.

Form with *Sulphur* a brownish red fluid of a disagreeable smell (*Balsamum Sulphuris P. L.*) Combine also by the assistance of heat, with most of the *Bituminous Bodies*.

Considered as differing principally from the *Volatile* or *Essential Oils*, in containing different portions of *Mucilage*.

Employed in *Painting*, *Varnishing*, *Soap-making*, in *Mechanics*, for *Fuel*, in *Diet*, *Medicine*, &c.

Of

Of Sperma-ceti.

Obtained from the brain of a particular species of whale, (*Cetus dentatus* Lin.) thence called the Sperma-ceti whale; obtained also in small quantity from the oil of the same fish.

After refinement, *white, semitransparent, crystalline, friable, insipid, inodorous.*

Differs chiefly from the fixed oils in being little altered by distillation, and not easily acted upon by *Acids* or *Alkalies*.

Supposed to have the same relation to *Unctuous Oils* that *Camphor* has to the *Essential*.

Used chiefly for making *Sperma-ceti candles*, and in the composition of *Ointments, Plaisters, &c.*

Of Bees-Wax.

Deposited by the *Bee* in the construction of the *Honey-comb*. Colour, *yellow*.

Very analagous to *Fixed Oils* in all its essential properties.

Becomes

Becomes white on exposure to *Air*, or treatment with the *Oxygenized Muriatic Acid*.

Forms the basis of several *Cerates*, *Ointments*, and *Plaisters*. *Poultice*

Employed also in several of the *Arts*, but principally in making *Wax candles*.

Of Volatile or Essential Oils.

Obtained from most fragrant vegetables by expression, or distillation with *Water*.

Taste *pungent*. Odour, colour, and consistence, *various*. Most of them lighter, some heavier than *Water*.

Thicken and become less odorous by absorbing *Oxygen* when exposed to *Air*; hence the supposed formation of *Balsams* and *Resins*, which differ chiefly in consistence and the occasional presence of *Benzoic Acid*.

Also affected by exposure to *Light*.

Sparingly soluble in *Water*; but readily so in *Alcohol*.

Volatile in close vessels, at or under the temperature of 212 *Farenh*. By repeated distillation

lation lose their characteristic properties, and are brought nearly to resemble each other.

Highly inflammable when heated in contact with *Air*.

Decompose the stronger *Acids*; in some instances with such rapidity as to occasion actual *Combustion*.

May be united with the *Alkalies* and *Lime* so as to form *Soaps*.

Combine intimately with *Sulphur*:

Combine also with *Phosphorus*, *Unctuous Oils*, and *Camphor*.

Purity ascertained by solution in *Spirit*, or exposure to *Heat*.

Chiefly employed in *Medicine*.

Of Camphor.

Thought to be a *Volatile Essential Oil* combined with a large proportion of *Carbon*.

Exists in many of the fragrant plants, as *Lavender*, *Rosemary*, *Marjoram*, &c. but principally procured by distillation with water, from a particular species of laurel, (*Laurus Camphora* Lin.)

Requires

Requires the addition of a small quantity of *Lime*, in its subsequent refinement by sublimation.

White. Transparent. Friable. Taste pungent and bitterish. Specifically lighter than Water.

Evaporates completely if kept exposed to the *Air*.

Burns with a white flame, and is entirely consumed.

Sparingly soluble in *Water*; but readily so in *Spirit of Wine* and *Æthers*, in *Unctuous* and *Essential Oils*.

Dissolves both in the *Sulphuric* and *Nitric Acid*, without decomposition; by repeated distillation with the latter, is converted into a peculiar *Acid*.

Chiefly employed in *Medicine*.

Of Bituminous Bodies.

Found either liquid and devoid of colour, *Naphtha*; or more or less liquid and of a dark colour, *Petroleum*, *Barbadoes Tar*; of a harder consistence, *Maltha*; or perfectly solid, black,
and

and of a compact or flaty texture, *Asphaltum*, *Jet*, *Coal*.

The more liquid Bitumens by continued exposure to *Air*, convertible into the more consistent, and all yielding similar products in distillation. In the different kinds of *Coal* there exists more or less *earthy* admixture, and often *Iron Pyrites*.

The *bituminous* bodies immiscible with *Water* and insoluble in *Spirit of Wine*.

Of Amber.

Nearly allied to the foregoing.

Found for the most part in irregular masses more or less transparent, and of a brownish or yellowish colour.—Specific gravity from 1.055 to 1.000. Emits a peculiar odour on friction and becomes *electric*. Melts at 550° *Farenh*. Burns with a whitish flame. In distillation yields *Water*, *Empyreumatic Oil*, (*Oleum Succini* P. L.) and a concrete *Acid*, (*Sal Succini* P. L.)

Insoluble in *Water* and nearly so in *Spirit of Wine*, also in all the acids, the *Sulphuric Acid* excepted, in the solutions of the *Alkalies*, and
in

in *essential* and *expressed* Oils ; but the *Balsams* dissolve it readily.

Of the methods usually employed for rendering *Amber* transparent.

Is probably of *vegetable* origin.

ORGANISED BODIES.

Form two classes, *Vegetable* and *Animal*, consisting nearly of the same constituent principles or elements, but in different proportions.

The chemical affinities of the constituent principles of both, influenced by the *living principle*.

Carbon, *Hydrogen* and *Oxygen* the principal constituent parts of *Vegetables*, as furnished by *Analysis*. They also contain *Saline*, *Earthy* and *Metallic* matter, the latter in small quantity.

Circumstances in which *Vegetable* substances differ from *Animal*.

Vegetable Substances.

Their *natural* component parts and productions are, *Cork*, *Woody-fibre*, *Tan*, *Colouring Matter*,

Matter, Extract, Oils, Resins, Wax and Tallow, Camphor, Gum, Jelly, Gluten, Albumen, Cacoutchouc, Starch, Sugar, Native Salts and Earth.

Several of these already spoken of.

Cork,—the exterior part of the *Quercus Suber*, a substance *sui generis*. Yields *Suberic Acid* by treatment with the *Nitric Acid*.

Woody-fibre,—that which is left after the digestion of ligneous matter in *Water* and *Alcohol*.

Tan,—contained in all astringent vegetable substances, but most plentifully in *Catechu* and the *Gall Nut*, from the concentrated infusions of which it may be precipitated by *Carbonate of Potash* or by *Acids*. When dry is of a brown colour, brittle, of a very astringent taste, very soluble in *Water*, and still more so in *Alcohol*.—Forms an insoluble compound with *Glue*, and produces a deep blue precipitate when added to the solution of *Oxy-sulphate of Iron*. On distillation yields an *Acid Liquor*, a small proportion of *Empyreumatic Oil* and about $\frac{1}{38}$ its quantity of *Charcoal*.

Colouring Matter,—that part of *Vegetable Substances* which is attracted by the fibres of
Silk,

Silk, Linen, Wool, &c. in the act of dying.—Differs in its other properties according to the subject from which it is obtained.

Extract,—obtained from the watery infusion of *Saffron*, and many other plants, by evaporating it to dryness. Distinguishable from all other vegetable substances by being soluble both in *Water* and in *Alcohol*, but not in *Sulphuric Æther*.

Gum,—procured most plentifully from certain species of *Mimosa*. When pure, colourless, insipid, soluble in *Water* but not in *Alcohol* or *Oils*.—Not prone to decomposition by keeping.—Soluble in the *Vegetable Acids* without alteration, but decomposed by the *Mineral*. 100 parts said to consist of 65.38 *Oxygen*, 23.08 *Carbon*, and 11.54 *Hydrogen*.—An article of the *Materia Medica*; useful also in divers manufactures, particularly in *Calico Printing*.

Jelly,—obtained from the expressed juice of *Currants*, and many other fruits, in the form of *Coagulum*, by allowing the juice to remain for some time at rest, decanting off the thinner part, and washing the remainder in a small quantity of water.—In this state is nearly colourless, and of a tremulous consistence.—Soluble in hot water, but again coagulates in cooling.

cooling.—When dried becomes transparent.—Combines readily with *Alkalies*, and by the *Nitric Acid* is converted into *Oxalic*.

Gluten,—the grey coloured tenacious and insipid substance which is left behind in washing the paste of *Wheaten Flour* in repeated portions of *Water*. In its *moist* taste much disposed to putrify.—When dried resembles *Glue*.—In boiling water loses its tenacity.—Soluble in all the acids, and in solutions of the *Alkalies*, by the assistance of heat.—Insoluble in *Water*, *Alcohol*, *Æthers* and *Oils*.—Differs from most other *Vegetable* substances, and resembles *Animal* in containing *Azote*.

Albumen,—so called from its resemblance to white of egg.—Obtained by exposing to a boiling heat, the water employed in the preparation of *Starch* from flour, or the depurated expressed juice of *Scurvy-grass*, *Cresses*, and most other cruciform plants.—Separates at this temperature in the form of *Coagulated Flakes*.—Is also precipitated from its watery solutions by *Alcohol* and *Acids*.—When dried resembles *Glue*, and is then readily soluble in *Alkalies*.—In distillation yields *Carbonate of Ammonia*, and consequently contains *Azote*.

Caoutchouc,

Caoutchouc,—the inspissated milky juice of certain trees, the *Hævea Caoutchouc*, *Iatropa Elastica*, and others growing chiefly in *South America*. When fresh is of an ash colour; without taste or smell.—Very elastic.—Sp. Gr. 0.933.—Not altered by *Air*.—Perfectly insoluble in *Water*.—Soluble in *rectified Petroleum*.—*Volatile Oils*, and in pure *Æther*, but not in *Alcohol*.—Is decomposed by the assistance of heat both by the *Sulphuric* and *Nitric Acids*, but not affected by *Alkalies*.—Melts readily when heated, yields *Ammonia* in distillation, and in the open fire burns with a white flame.

Starch,—the grey or white sediment deposited by *Wheaten Flour*, *Potatoes*, and various other vegetable substances, after diffusion in water.—Has scarcely any smell, and but little taste; though insoluble in *cold Water*, combines with it by *boiling* into a kind of *Mucilage*.—Altogether insoluble in *Alcohol*, and not readily acted on by *diluted Acids*; but soluble without decomposition by *Alkalies*, unless when they are concentrated and assisted by heat. By destructive distillation yields a large proportion of *Carbon*. Supposed to be converted into *Sugar* in the process of *Malting*.

Sugar,

Sugar,—the produce of the *Arundo Saccharifera* or *Sugar Cane*, *Sugar Maple*, *Beet*, *Carrot*, and many other vegetables.—When purified, of a white colour, sweet; inodorous, not subject to alteration by exposure to Air; very soluble in water, and crystallizable; soluble also in *Alcohol*, but not in so large a proportion.—Readily decomposed both by the *Sulphuric* and *Nitric Acids*; in the weaker *Acids* merely soluble.—Forms with *Potash* a bitter astringent compound, insoluble in *Alcohol*; forms a similar one with *Lime*. On decomposition by heat yields *Water*, *Carbonic Acid*, *Carbonated Hydrogen Gas*, *Empyreumatic Oil*, *Acetous Acid*, and *Charcoal*.—100 parts consist, according to *Lavoisier*, of 64 *Oxygen*, 28 *Carbon*, and 8 *Hydrogen*.

Animal Substances.

Yield in general, by analysis, more *Azote* than *Vegetables*.

Their principal constituent parts and productions are, *Fibrine*, *Albumen*, *Gelatine*, *Mucilage*, *Urea*, *Sugar*, *Oils*, *Resins*, *Sulphur*, *Phosphorus*, *Acids*, *Alkalies*, *Earths*, *Metals*.

Those

Those not already treated of are,

Fibrine,—commonly called coagulable lymph, is that which remains on washing the crassamentum of blood in successive portions of water, till it cease to give out any colour. Bears a strong resemblance to muscular fibre; is white, tasteless, soft, ductile, elastic, insoluble either in *Water* or *Alcohol*; in boiling water becomes hard and inelastic; in its soft state much disposed to putrify; by long digestion in water is converted into a particular species of tallow.—Soluble in most of the *Acids*, and in the stronger solutions of both the *fixed Alkalies*, with which, by the assistance of heat, it forms a viscid bitter soap. In distillation yields a large proportion of *Ammonia*.

Albumen,—contained in the serum of blood, and in various other animal substances; most abundantly in white of egg. In its moist and fresh state is nearly without colour, taste or smell—viscid—readily soluble in cold water—distinguishable from other animal fluids by coagulating at a temperature of 165 *Farenh.*—*Acids* and *Alcohol* produce on it a similar effect. When coagulated is insoluble in water.—*Tan* added to its aqueous solution, forms with it a
copious

CHEMICAL NOMENCLATURE.

SIMPLE BODIES.	—RENDERED INTO GAS BY CALORIC.	—COMBINED WITH OXYGEN.	—OXYGENATED AND GASEOUS.	—OXYGENATED WITH BASES.	—IN COMBINATION INDEPENDENTLY OF OXYGEN.
Light.					
Caloric. <i>Matter of heat.</i>					
Oxygen. <i>Acidifying principle. Base of vital air.</i>	Oxygen gas. <i>Vital, dephlogisticated, pure or empyreal air.</i>				
Hydrogen. <i>Base of inflammable air.</i>	Hydrogen gas. <i>Inflammable air.</i>	Oxyd of Hydrogen. <i>Water.</i>			Hydrocarbonic gas. <i>Heavy inflammable air.</i> Sulphurated hydrogen gas. Phosphorated hydrogen gas.
Azote, Nitrogen. <i>Nitric radical, Base of phlogisticated air.</i>	Azotic gas, Nitrogen gas. <i>Phlogisticated air, Mofete.</i>	Nitrous oxyd. Oxyd of azote. <i>Base of nitrous air.</i> Nitrous acid. <i>Phlogisticated or smoaking ni- trous acid.</i> Nitric acid. <i>Dephlogisticated or colourless ni- trous acid.</i>	Gaseous oxyd of azote. <i>Dephlogisticated nitrous air.</i> Nitrous gas. <i>Nitrous air.</i> Nitrous acid gas. <i>Nitrous acid air.</i>	Nitrite of potash, &c. Nitrate of potash—of soda, &c. <i>Saltpetre or common nitre— cubic nitre, &c.</i>	Azotic hydrogen gas. <i>Ammoniacal air, alkaline air.</i>
Carbon. <i>Carbonic radical, Diamond, Pure charcoal.</i>		Carbonic acid. <i>Fixed air.</i>	Carbonic acid gas. <i>Fixed air, aerial acid.</i>	Carbonate of lime--of potash, &c. <i>Mild or aerated calcareous earth, vegetable alkali, &c.</i>	
Sulphur. <i>Sulphuric radical, Brim- stone.</i>		Sulphureous acid. <i>Volatile or phlogisticated vitri- olic acid.</i> Sulphuric acid. <i>Acid, oil or spirit of vitriol.</i>	Sulphureous acid gas. <i>Vitriolic acid air.</i>	Sulphite of potash, &c. <i>Stahl's sulphureous salt, &c.</i> Sulphate of potash. <i>Vitriolated tartar.</i> Sulphate of soda. <i>Glauber's Salt.</i> Sulphate of Alumine. <i>Common Alum.</i> Sulphate of iron. <i>Green Vitriol, &c.</i>	Sulphuret of potash--of soda, &c. <i>Alkaline hepars, Livers of sul- phur, &c.</i> Sulphuret of lime, &c. <i>Earthy hepars.</i> Sulphuret of iron—of lead— of antimony, &c. <i>Iron Pyrites—Potter's lead ore, galena—common or crude an- timony, &c.</i>
Phosphorus. <i>Phosphoric radical.</i>		Phosphorous acid. <i>Volatile phosphoric acid.</i> Phosphoric acid. <i>Fixed phosphoric acid.</i>		Phosphite of potash--of soda, &c. Phosphate of potash--of soda, &c. <i>Phosphorated kali, soda, &c.</i>	Phosphuret of lime. Phosphuret of iron, &c. <i>Siderite, &c.</i>
Muriatic radical.		Muriatic acid. <i>Marine acid, acid of sea salt.</i> Oxymuriatic acid. <i>Dephlogisticated marine acid.</i>	Muriatic acid gas. <i>Marine acid air.</i> Oxymuriatic acid gas. <i>Dephlogisticated marine acid air.</i>	Muriate of potash—of soda, &c. <i>Salt of Sylvius—Common salt, &c.</i> Oxymuriate of potash, &c.	
Boracic radical.		Boracic acid. <i>Sedative salt.</i>		Borate of potash—of soda, &c. <i>Vegetable borax—com. borax, &c.</i>	
Fluoric radical.		Fluoric acid. <i>Spathic acid.</i>	Fluoric acid gas. <i>Spathic acid air.</i>	Fluate of lime, &c. <i>Fluor spar, &c.</i>	
Succinic radical.		Succinic acid. <i>Salt of amber.</i>		Succinate of potash, &c.	
Acetic radical.		Acetous acid <i>Vinegar, distilled vinegar.</i> Acetic acid. <i>Radical vinegar.</i>		Acetite of potash--of ammonia-- of lead, &c. <i>Diuretic salt—Mindererus spi- rit—Sugar of lead, &c.</i> Acetate of potash.	

SIMPLE BODIES.	—RENDERED INTO GAS BY CALORIC.	—COMBINED WITH OXYGEN.	—OXYGENATED AND GASEOUS.	—OXYGENATED WITH BASES.	—IN COMBINATION INDEPENDENTLY OF OXYGEN.
Tartaric radical.		Tartareous acid. <i>Acid of cream of tartar.</i>		Tartrite of potash—of foda, &c. <i>Soluble tartar—Rochelle salt, &c.</i> Acidulous tartrite of potash. <i>Crystals or cream of tartar.</i>	
Pyrotartaric radical.		Pyrotartareous acid. <i>Empyreumatic acid of tartar.</i>		Pyrotartrite of potash, &c.	
Oxalic radical.		Oxalic acid. <i>Acid of sugar.</i>		Oxalate of lime—of foda, &c. Acidulous oxalate of potash. <i>Salt of sorrel.</i>	
Gallic radical.		Gallic acid. <i>Acid of galls.</i>		Gallate of potash—of lime, &c. Gallate of iron. <i>Common ink.</i>	
Citric radical.		Citric acid. <i>Acid of lemons.</i>		Citrate of potash—of lime, &c.	
Malic radical.		Malic acid. <i>Acid of apples.</i>		Malate of potash, &c.	
Benzoic radical.		Benzoic acid. <i>Acid or flowers of Benjamin.</i>		Benzoate of lime, &c.	
Pyrolignic radical.		Pyroligneous acid. <i>Acid of birch and other woods, and of tar.</i>		Pyrolignite of potash—of iron, &c.	
Pyromucic radical.		Pyro-mucous acid. <i>Spirit of honey of sugar, &c.</i>		Pyromucite of magnesia— Ammoniacal pyromucite, &c.	
Camphoric radical.		Camphoric acid. <i>Acid of camphor.</i>		Camphorate of potash, &c.	
Lactic radical.		Lactic acid. <i>Acid of Milk.</i>		Lactate of potash, &c.	
Saccholactic radical.		Saccholactic acid. <i>Acid of sugar of milk.</i>		Saccholate of lime, &c.	
Formic radical.		Formic acid. <i>Acid of ants.</i>		Formate of ammonia, &c.	
Prussic radical.		Prussic acid. <i>Acid or colouring matter of Prussian Blue.</i>		Prussiate of potash—of iron, &c. <i>Prussian or phlogisticated alkali— Prussian blue, &c.</i>	
Sebacic radical.		Sebacic acid. <i>Acid of fat.</i>		Sebate of foda—of lime, &c.	
Uric radical.		Uric acid. <i>Lithic acid. Acid of urinary calculus.</i>		Urate of foda, &c.	
Bombic radical.		Bombic acid. <i>Acid of silkworms.</i>		Bombiate of iron, &c.	
Zoonic radical.		Zoonic acid.		Zoonates of potash, &c.	
Suberic radical.		Suberic acid. <i>Acid of cork.</i>		Suberate of potash, &c.	

SIMPLE BODIES.	—RENDERED INTO GAS BY CALORIC.	—COMBINED WITH OXYGEN.	—OXYDATED AND WITH BASES.	—OXYGENATED AND WITH BASES.	—IN COMBINATION INDEPENDENTLY OF OXYGEN.
Arsenic. <i>Regulus of arsenic.</i>		Oxyd of arsenic. <i>White arsenic, arsenious acid.</i> Arsenic acid.	Sulphurated oxyd of arsenic, yellow and red. <i>Orpiment,</i> <i>Realgar.</i> Alkaline oxyd of arsenic. <i>Liver of arsenic.</i>	Arseniate of potash, &c. <i>Arsenical salt of Macquer.</i>	Alloy of arsenic and tin, &c.
Tungsten. <i>Regulus of tungsten</i> <i>Scheele.</i>		Oxyd of tungsten. <i>Yellow calx of tungsten.</i> Tungstic acid.		Tungstate of lime, &c. <i>Lapis ponderosus.</i> Tungstate of iron, with man- ganese, &c. <i>Wolfram.</i>	Alloy, &c.
Molybdena. <i>Regulus of molybdena.</i>		Oxyd of molybdena. <i>Calx of molybdena.</i> Molybdic acid.	Sulphurated oxyd of molyb- dena. <i>Molybdena.</i>	Molybdate of potash—of lead, &c.	Alloy, &c.
Chrome.		Oxyd of chrome. Acid of chrome.		Chromate of potash—of lead, &c. <i>Red lead ore of Sibe- ria.</i>	Alloy, &c.
Titanite. <i>Metal of menachanite.</i>		Oxyd of titanite.	Alkaline oxyd of titanite.		Alloy, &c.
Uranite. <i>Regulus of uranite.</i>		Oxyd of uranite. <i>Yellow calx of uranite.</i>			Sulphuret of uranite, &c. <i>Pechblende.</i>
Cobalt.		Oxyds of cobalt of different colours. <i>Calces of cobalt.</i>	Alkaline cobaltic oxyds. <i>Precipitates of cobalt re-dissolved by alkalis.</i>		Alloyed with arsenic. <i>Grey cobalt ore.</i>
Nickel.		Oxyd of nickel. <i>Calx of nickel.</i>			Alloyed with iron, &c.
Manganese. <i>Regulus of manganese.</i>		Oxyds of manganese of differ- ent colours. <i>Calces of manganese.</i>	Alkaline oxyd of manganese. <i>Mineral cameleon.</i>		Alloyed with iron, &c.
Bismuth.		Oxyds of Bismuth—yellow— white—vitreous. <i>Yellow calx of bismuth—ma- gistry of bismuth.</i> <i>Spanish white.</i>	Alkaline oxyd of bismuth.		Alloyed with tin. Sulphuret of bismuth.
Antimony. <i>Regulus of antimony.</i> <i>Stibium.</i>		Oxyds of antimony, 1. by nitric acid. <i>Diaphoretic antimony.</i> 2. by muriatic acid. <i>Powder of algaroth.</i> 3. by sublimation. <i>Argentine flowers.</i> 4. by vitrification. <i>Glass of antimony.</i>	Alkaline oxyds of antimony. <i>Livers of antimony.</i> Hydrosulphurated oxyds of antimony. <i>Kermes mineral—Golden sulphur of antimony.</i>		Alloyed with lead, &c. <i>Printer's types, &c.</i> Sulphuret of antimony. <i>Crude antimony.</i>
Tellurium. <i>Sylvanite.</i>		Oxyd of tellurium.			Alloyed with gold, silver, &c. <i>White and grey gold ores.</i>
Zinc. <i>Spelter.</i>		Oxyds of zinc. <i>Calx of zinc, flowers of zinc.</i> <i>Lapis calaminaris, &c.</i>	Sulphurated oxyd of zinc. <i>Precipitate of zinc by liver of sulphur, blende.</i>		Alloyed with copper, &c. <i>Brass, &c.</i>

METALS.	SIMPLE BODIES.	—RENDERED INTO GAS BY CALORIC.	—COMBINED WITH OXYGEN.	—OXYDATED AND WITH BASES.	—OXYGENATED AND WITH BASES.	—IN COMBINATION INDEPENDENTLY OF OXYGEN.
	Tin. <i>Jupiter.</i>		Oxyds of tin, grey and white. <i>Calx of tin—Flowers of tin, &c.</i>	Sulphurated oxyd of tin, black and yellow. <i>Aurum musivum.</i>		Alloyed with lead, bismuth, &c. <i>Pewter, soft solder, &c.</i>
	Lead. <i>Saturnus.</i>		Oxyds of lead of different colours. <i>White lead, Cerusse—Litharge—Red lead, minium, &c.</i>	Sulphurated oxyd of lead. <i>Sulphurated calx of lead.</i>		Alloyed with tin, &c. Sulphuret of lead. <i>Galena, Potters lead ore.</i>
	Iron. <i>Mars.</i>		Oxyds of iron of different colours. <i>Martial Æthiops—Ochre—Colcothar, &c.</i>	Sulphurated oxyd of iron. <i>Sulphurated calx of iron.</i>		Alloyed with arsenic, &c. <i>Red short iron, &c.</i> Carburet of iron. <i>Steel.</i> Phosphuret of iron. <i>Cold short iron, Siderite.</i> Sulphuret of iron. <i>Iron pyrites.</i>
	Copper. <i>Venus.</i>		Oxyds of copper brown and red. <i>Calces of copper.</i>	Ammoniacal oxyd of copper. <i>Cuprum ammoniacum.</i>		Alloyed with zinc, &c. <i>Brass, &c.</i> Sulphuret of copper. <i>Copper pyrites.</i>
	Quicksilver. <i>Mercury.</i>		Oxyds of quicksilver. 1st. Black. <i>Æthiops per se.</i> 2d. Grey. 3d. White. <i>White precipitate.</i> 4th. Yellow. <i>Turpeth mineral.</i> 5th. Red. <i>Red precipitate.</i> <i>Calcin'd quicksilver.</i>	Sulphurated oxyd of quicksilver, black and red. <i>Æthiops mineral. Cinnabar.</i>		Amalgamated with gold, &c.
	Silver. <i>Luna.</i>		Oxyd of silver. <i>Calx of silver.</i>	Ammoniacal oxyd of silver. <i>Argentum fulminans.</i>		Alloyed with copper, &c.
	Gold. <i>Sol.</i>		Oxyd of gold. <i>Calx of gold.</i>	Ammoniacal oxyd of gold. <i>Aurum fulminans.</i>		Alloyed with silver, copper, &c.
	Platina. <i>White gold.</i>		Oxyd of platina. <i>Calx of platina.</i>			Alloyed with copper, &c.

EARTHS AND ALKALIS.

Silex. <i>Vitrifiable or flinty earth, quartz.</i>	Alumine. <i>Argillaceous earth, clay.</i>	Baryt. <i>Ponderous earth.</i>	Strontian. <i>Earth of strontianite.</i>	Lime. <i>Calcareous earth.</i>	Magnesia. <i>Muriatic earth.</i>	Zircon. <i>Jargon earth.</i>	Glucine.	Yttria.	Agustine.	Potash. <i>Vegetable alkali.</i>	Soda. <i>Mineral alkali, natron.</i>
COMPOUND VEGETABLE AND ANIMAL CONSTITUENT PARTS AND PRODUCTIONS.											
Mucus.	Gum.	Gluten.	Sugar.	Starch.	Fixed oils. <i>Fat or unctuous oils</i>	Volatile oils. <i>Essential oils.</i>	Aroma. <i>Spiritus rector.</i>	Resin.	Camphor.	Waxy matter.	Tannin. <i>Astringent principle.</i>
Extractive matter.	Fecule. <i>Sediment.</i>	Woody matter.	Alcohol.	Æther.	Serum.	Lymph.	Albumen.	Gelatin. <i>Animal gluten.</i>	rin. <i>Animal fibre.</i>	heefy matter.	Officic matter.

copious yellow coloured tenaceous precipitate, which, when dried, is brittle, and not susceptible of putrefaction.—*Albumen* soluble in *Alkalies* and *Alkaline Earths*:—In distillation yields the same products as *Fibrine*, but with a less proportion of *Ammonia*.

Gelatine,—or Jelly, obtained by boiling certain animal substances, particularly skin, in common water, evaporating the decoction to the necessary degree of consistence, and allowing it to cool.—When pure, transparent and colourless. Soluble both in cold and hot water, very readily in the later, even at a temperature of 90 *Farenh.*—By drying becomes semi transparent, hard, brittle, and of a vitreous fracture, *Glue*.—Is insoluble in *Alcohol*; *Alkalies* require the assistance of heat, but *Acids* dissolve it with great facility, even when diluted.—With *Tan* it forms, like *Albumen*, a yellowish coloured plastic compound, insoluble in water, and not susceptible of putrefaction; hence the theory of *Tanning*.—Heat decomposes it like other animal substances.

Urea,—procured from fresh *Urine* in the form of small crystalline plates, by evaporating it to the consistence of syrup, digesting this when

cold in *Alcohol*, distilling the solution so as to separate and collect the spirit, and allowing the residuum to crystallise by cooling. Thus obtained, its colour is *yellowish white*, smell *alliacous*, taste *strong* and *ammoniacal*, consistence *viscid*, extremely soluble in *Water*, somewhat less so in *Alcohol*, soluble also in the aqueous solutions of both the *Fixed Alkalies* and in *Marine Acid*.—By the *Sulphuric* and *Nitric Acids* it is decomposed, as it is likewise very easily by exposure to *heat*, even to that of boiling water. According to *Vauquelin*, 100 parts yield in distillation 92.02 *Carbonate of Ammonia*, 4.60 *Carbonated Hydrogen Gas*, and 3.22 *Charcoal*.

The term *Mucilage*, given to those animal substances which are soluble in *Water*, but not in *Alcohol*; are not coagulable by *Heat* nor form a jelly by evaporation, and do not afford a precipitate on the addition of *Tan*.

THE END.